VOL. XX. No. 12

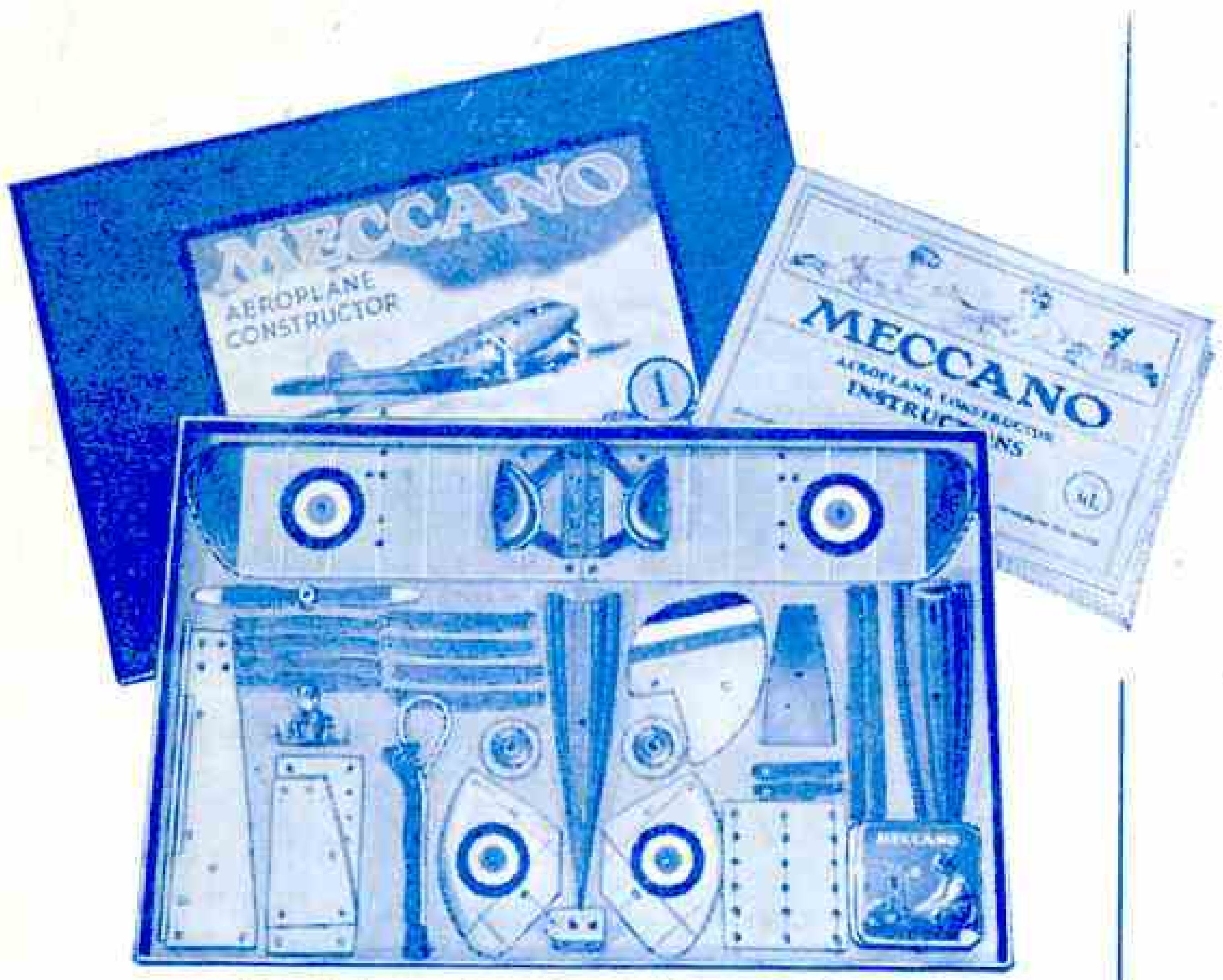
DECEMBER 1935

MECCANO MAGAZINE

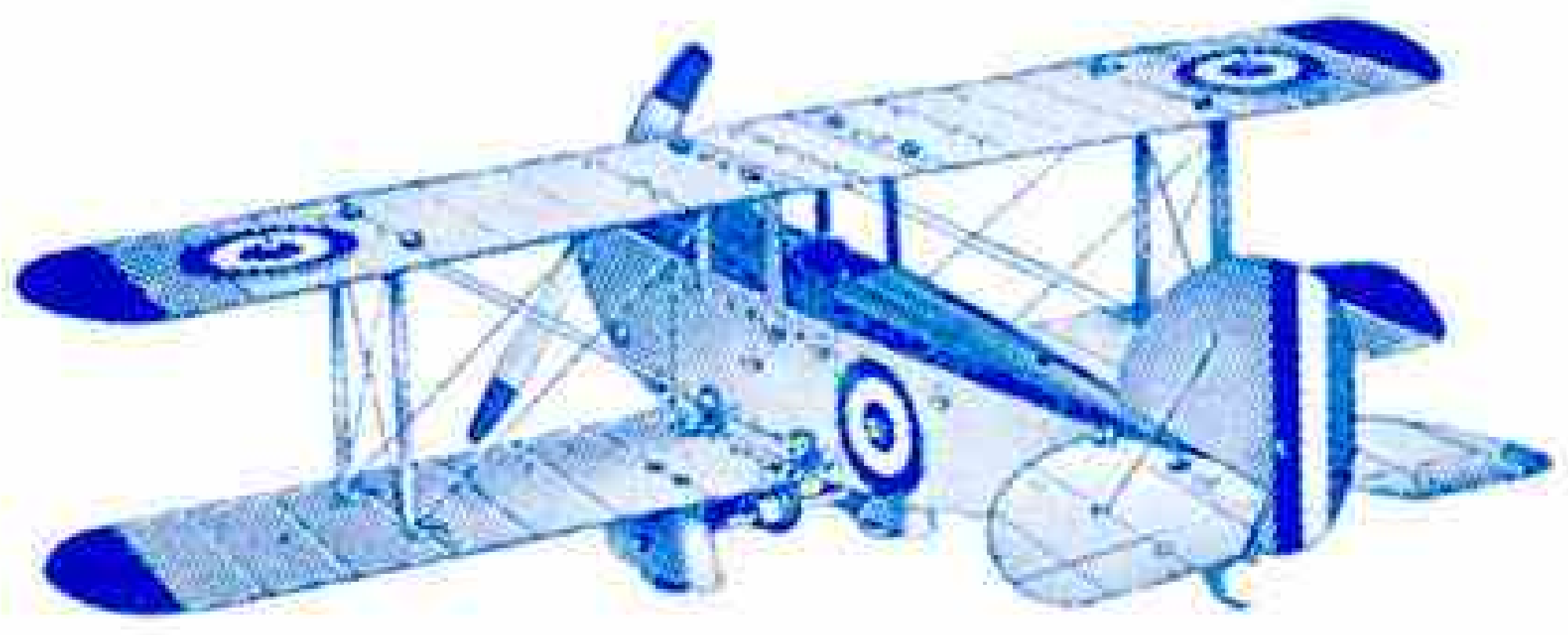
6D.

GIANT PLANO-MILLING MACHINE
(see page 686)

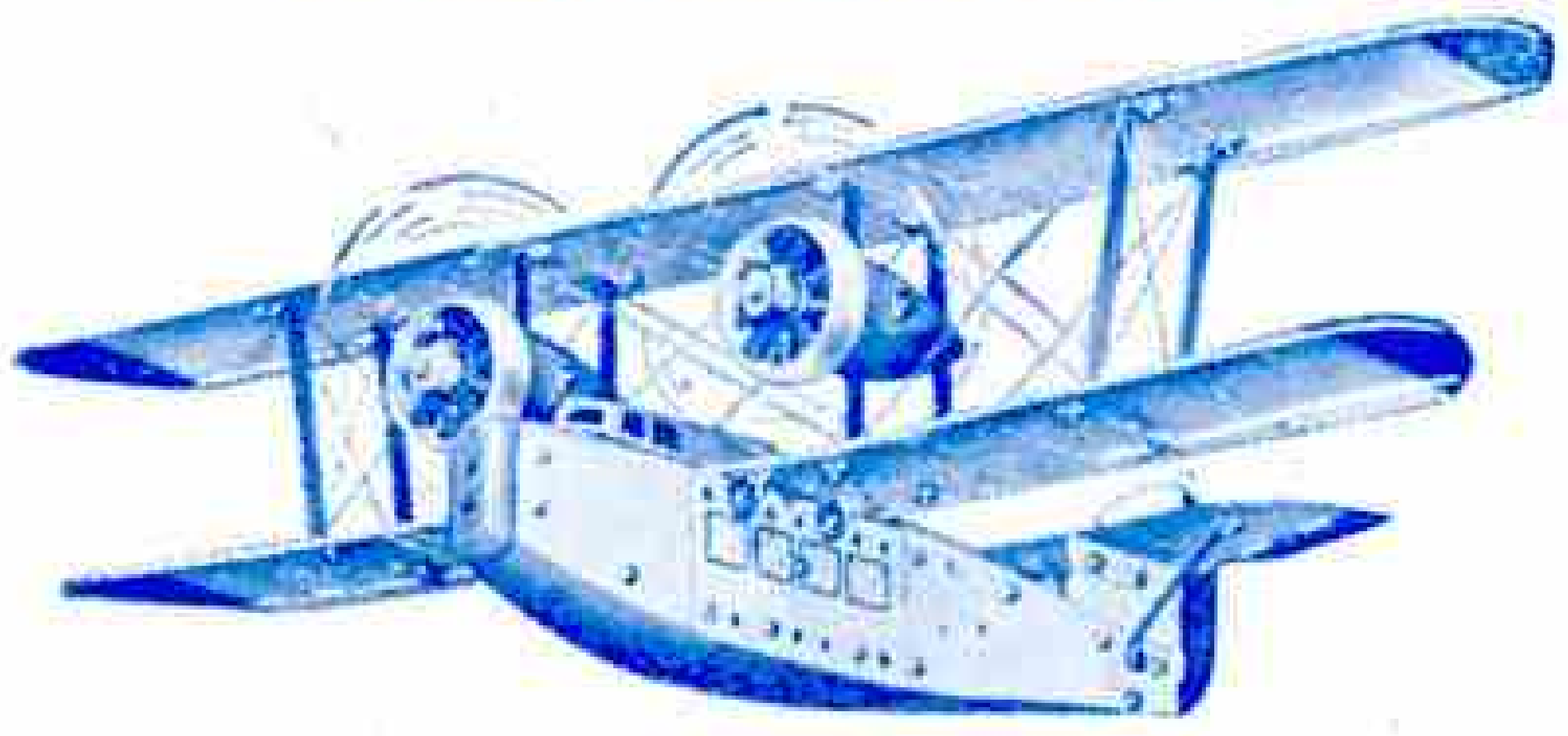
ANOTHER OF MECCANO LTD'S FAMOUS TOYS



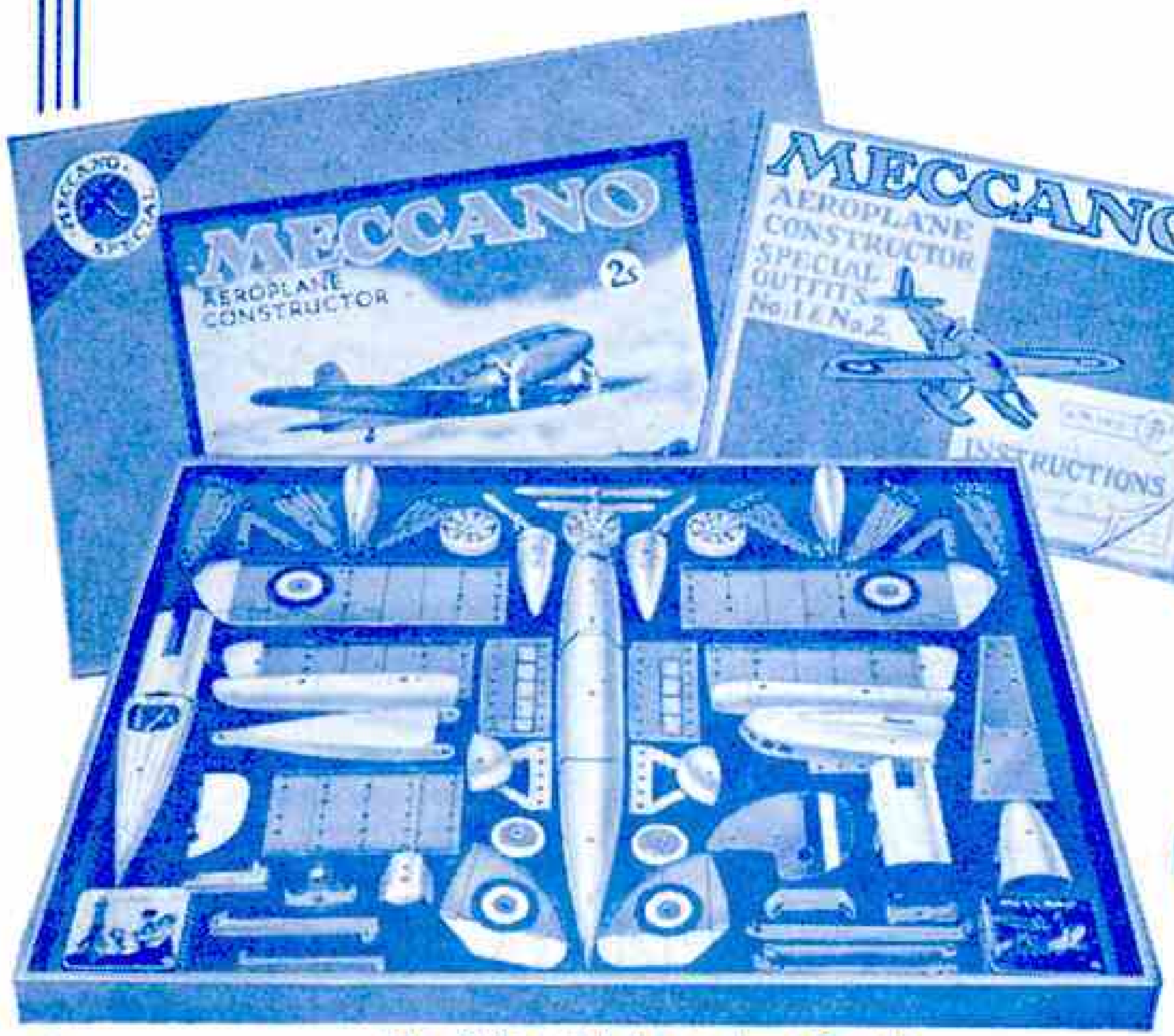
No. 1 Aeroplane Outfit. Price 7/6



Model of a Standard Light Biplane built with No. 1 Aeroplane Outfit.



Model of a Commercial Flying Boat built with No. 2 Special Aeroplane Outfit



No. 2 Special Aeroplane Outfit.
Price 21/-

AEROPLANE CONSTRUCTOR

Boys, building Aeroplane models with these splendid Aeroplane Outfits is great fun! Each model you make is a joy to look at and a delight to play with.

A beautifully illustrated Manual is included in each Aeroplane Outfit showing how to build a number of different models, both monoplanes and biplanes. Many other splendid models may be built by varying the position of the parts, which are all interchangeable on the famous Meccano principle. The parts in the Nos. 1 and 2, 1 Special and 2 Special Outfits can be used in conjunction with the standard Meccano parts.

Price List

Standard Series

No. OO AEROPLANE OUTFIT

This splendid new Outfit contains a good selection of Aeroplane parts with which realistic Aeroplane models can be built. It is an ideal present for young boys who are keen on aeroplanes. Price 3/3

No. O AEROPLANE OUTFIT

An interesting range of models can be built with this Outfit, including high and low wing monoplanes, seaplanes and standard light biplanes. Price 4/6

No. 1 AEROPLANE OUTFIT

Magnificent models of high and low wing monoplanes, and interesting model biplanes representing standard types can be built with this fine Outfit. Price 7/6

No. 1a Aeroplane Accessory Outfit, costing 6/–, will convert a No. 1 Outfit into a No. 2.

No. 2 AEROPLANE OUTFIT

This Outfit enables a much wider range of models to be built, including triple-engined monoplanes and biplanes, and a racing seaplane of the type that was used in the Schneider Trophy Contests. Price 12/6

Note. The parts in the No. OO and No. O Aeroplane Outfits are smaller than those in the other Outfits in the series and are not intended for use with these Outfits.

Special Series

No. 1
SPECIAL AEROPLANE OUTFIT

The parts in this super Aeroplane Outfit will build over 20 realistic models of different types of aircraft. The range of special parts includes mainplanes fitted with ailerons, tail planes with elevators, movable rudder, radial engine cowling, etc. Price 12/6

A No. 1a Special Aeroplane Accessory Outfit, Price 10/–, will convert a No. 1 Special Outfit into a No. 2 Special.

No. 2
SPECIAL AEROPLANE OUTFIT

This is the finest and most attractive Aeroplane Constructor Outfit on the market. It contains a big range of aircraft parts, with which numerous models of practically any type of machine may be built—44 examples are shown in the Manual of Instructions. All the parts that are features of the No. 1 Special Outfit are included, also a number of other parts of special design. Price 21/–

All Aeroplane Constructor Outfits are available in three different colour combinations.

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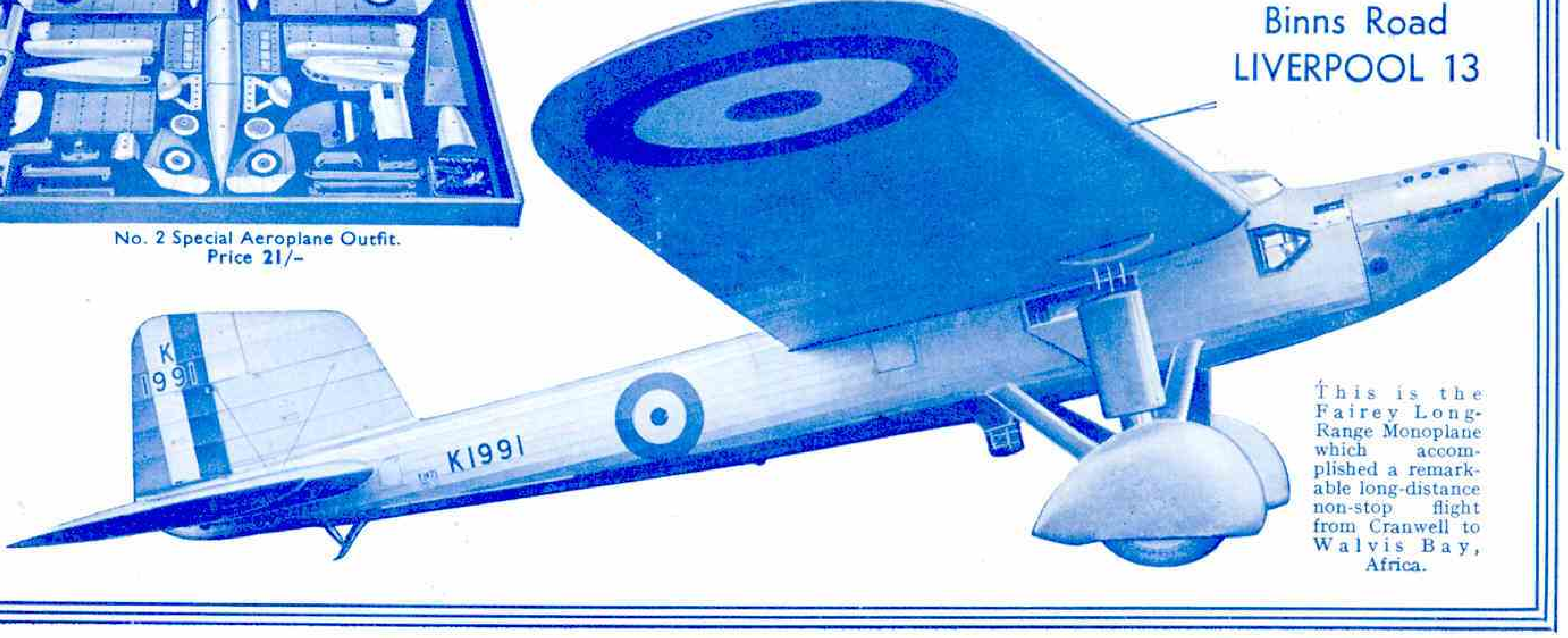

This is the Fairey Long-Range Monoplane which accomplished a remarkable long-distance non-stop flight from Cranwell to Walvis Bay, Africa.

Hamleys News

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Containing an electric torch, a clasp knife and a whistle on which is fitted a compass. Post 4d. Price **5/6**

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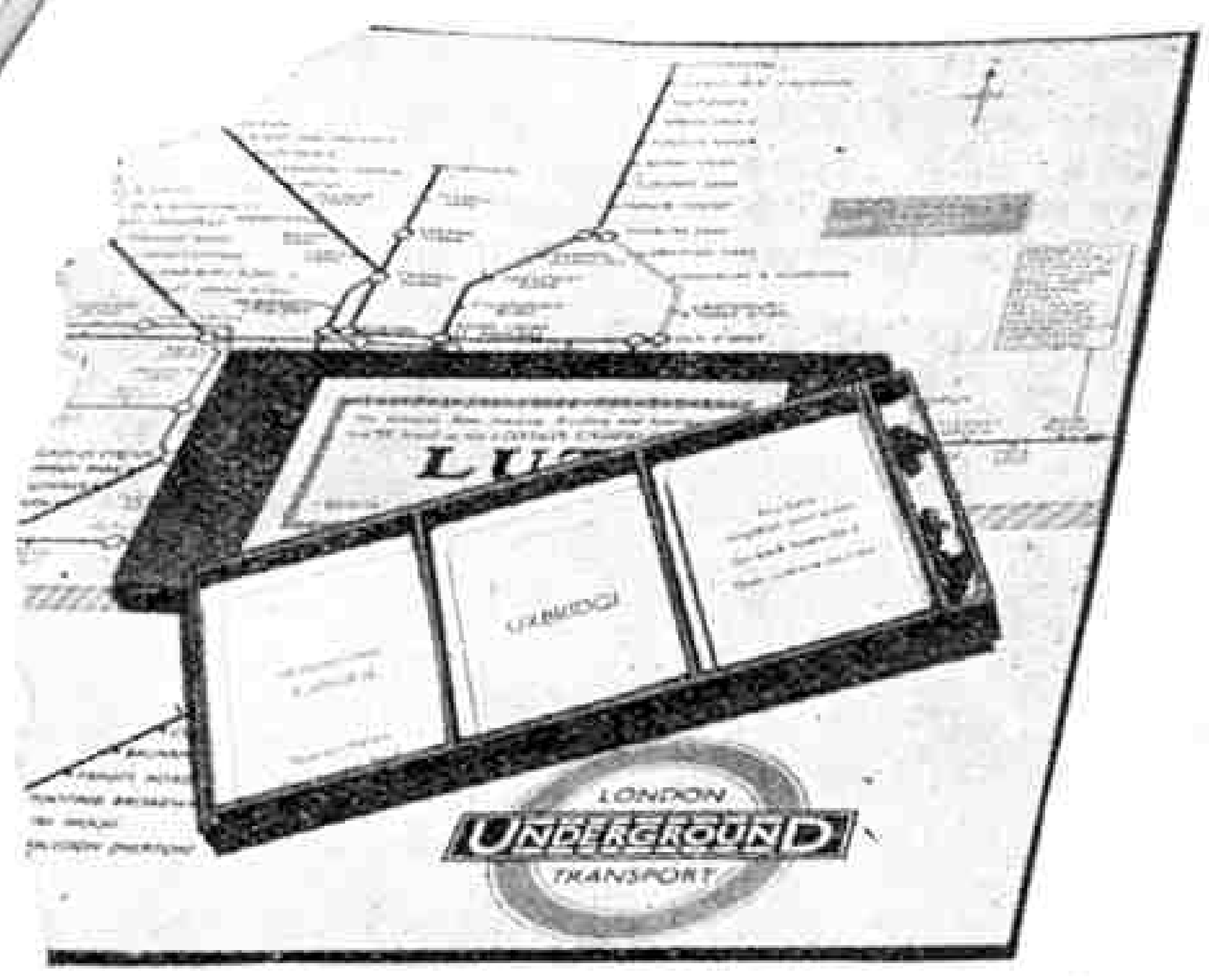
The very latest game—exclusive to Hamleys. It is thrilling, fascinating and skilful and is rapidly gaining popularity. Size 44 in. x 3½ in. Price **42/-** complete

THE STUDENT MICROSCOPE OUTFIT

High Power instrument. 40 x linear magnification with magnifier, dissecting needles, tweezers and collection jar. (Foreign.) Price **5/-** Post 6d.



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A game of the "Underground." The object is to journey from one station in London to another, avoiding such delays as "Lost Luggage," etc. Post. 6d. Price **5/-**

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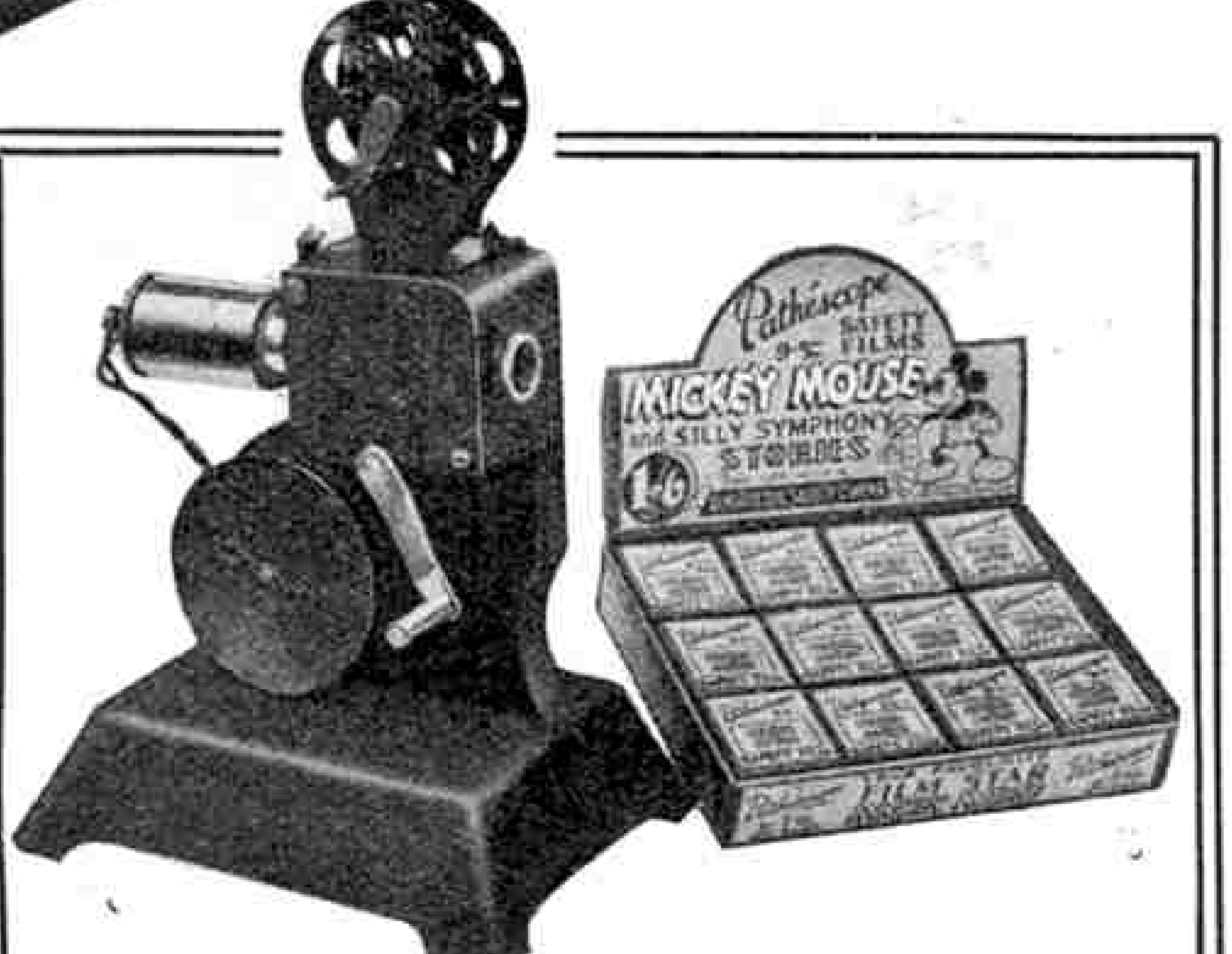
This box contains a number of superior tricks, specially selected and explained by Jasper Maskelyne, the famous magician and illusionist, so that anyone without previous knowledge can mystify and entertain friends with very little practice. Cabinet complete. Price **15/6** Post 1/–

This box also contains honorary membership of the "Yelmah" Magical Society, Hamleys own Magical Club.



THE NEW 9.5 m.m. PROJECTOR "BINGOSCOPE"

In connection with "Mickey Mouse" Pathescope film. Fitted finest quality condenser and focussing lenses. Double claw action and double shutter, absolutely flickerless.
Battery model **17/6** Batteries 1/3 extra. Post 9d.
All Mains model D.C. or A.C. 100 to 250 volts with resistance. Price **27/6**
Mickey Mouse Film: 15 ft. 1/6. 30 ft. 3/9. 60 ft. 6/6

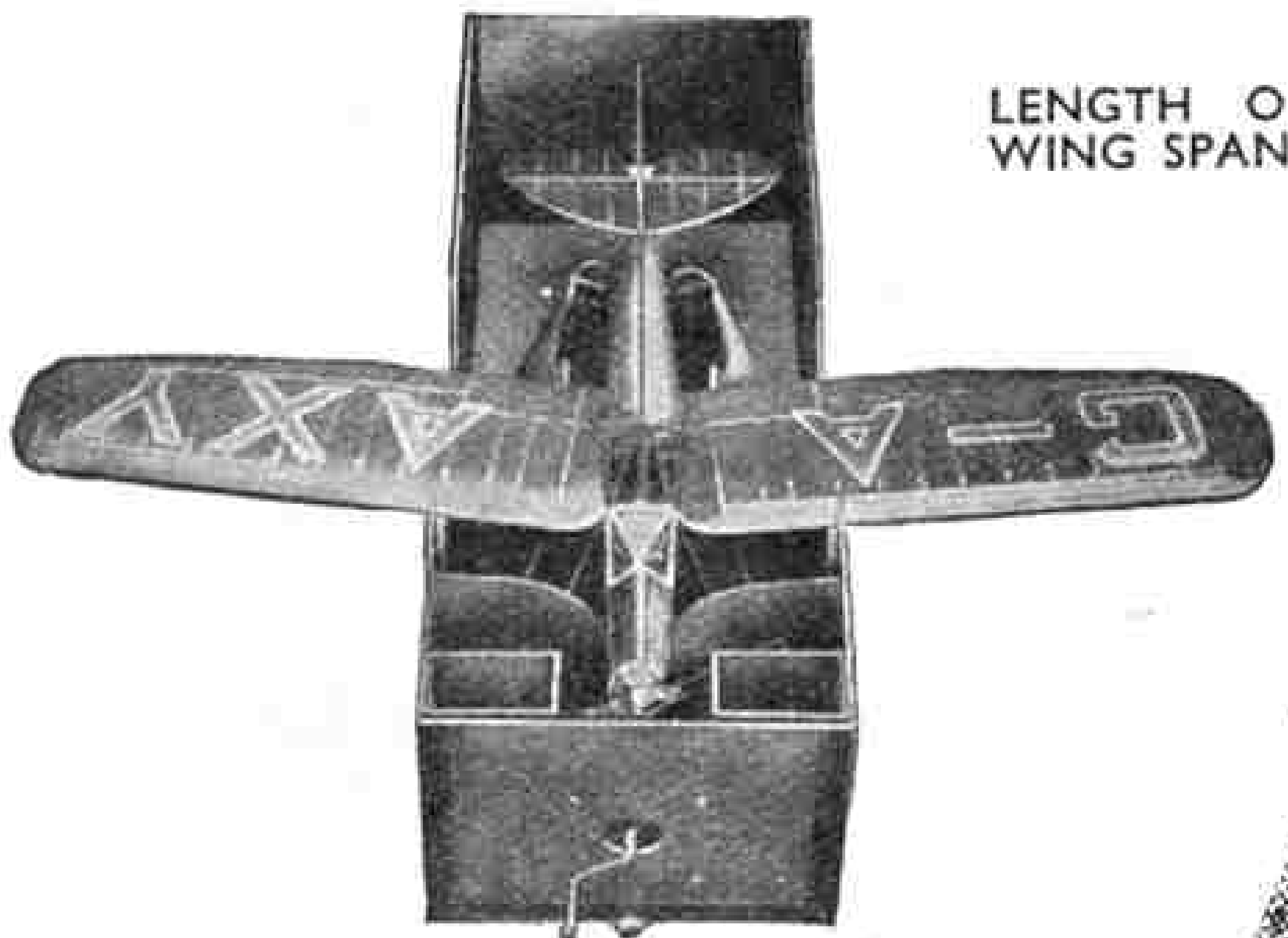
BUILD A REAL SCALE MODEL OF THE "QUEEN MARY"

Scale 1 in.–100 ft. This fine outfit includes ready made hull in one piece, all deck fittings, bridge, funnel bases and lifeboats. Also a transparent showcase 11 ins. long moulded and ebonized base with top decorated imitation sea. Easy to build a model that you will be proud of. Full instructions to assemble. Price **5/-** Post 6d.

FROG *Model Aircraft*

PUSS-MOTH Monoplane

A MAGNIFICENT FLYING SCALE MODEL OF THE FAMOUS RECORD-BREAKING LIGHT AEROPLANE



LENGTH OF FLIGHT 600 ft.
WING SPAN 18½ ins.

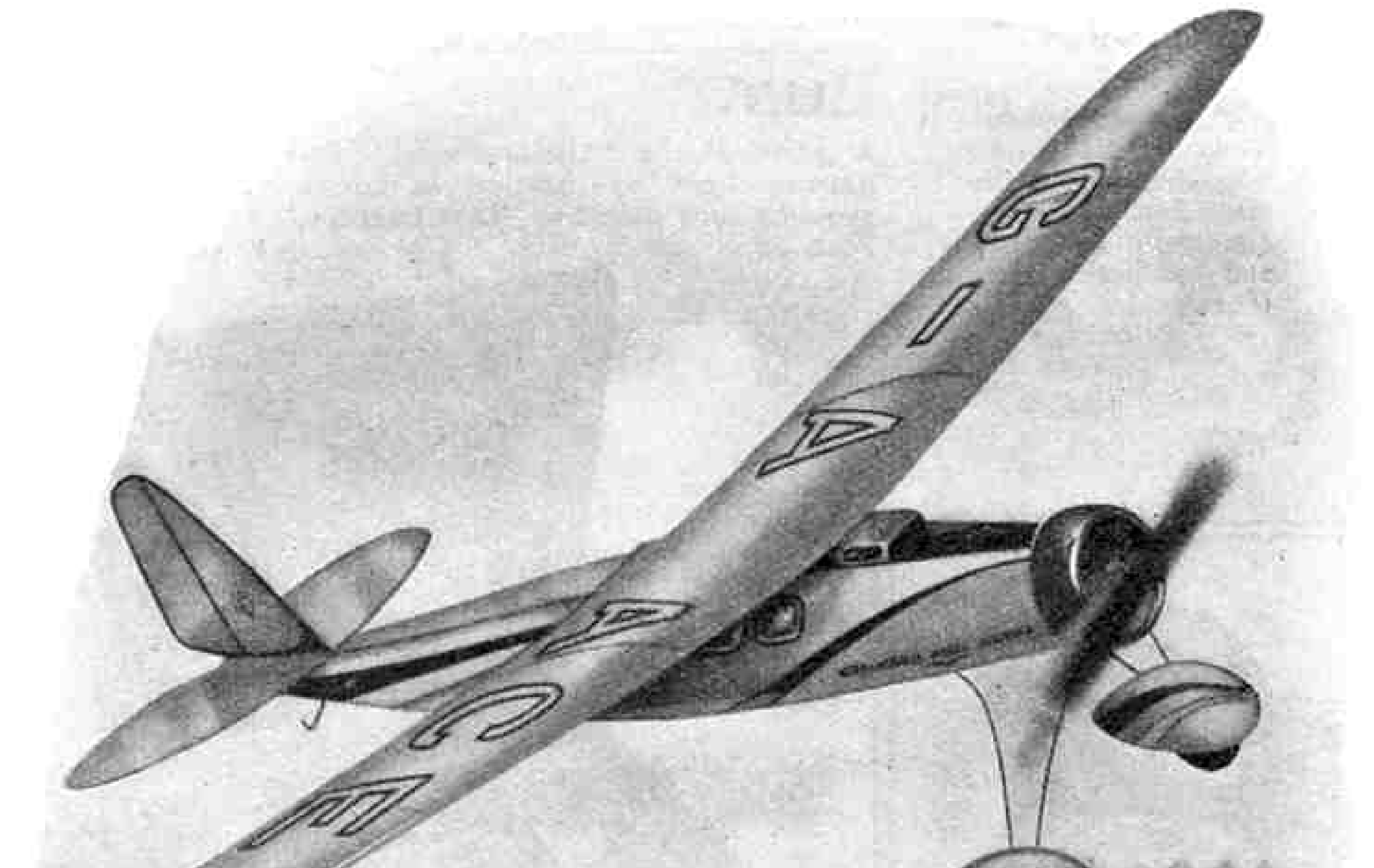
Complete with PATENT HIGH SPEED WINDER BOX, spare motors, dual insertor rod, motor lubricant, gear box oil and fully illustrated flying manual.

WILL RISE OFF THE GROUND

TRADE MARK REGD.

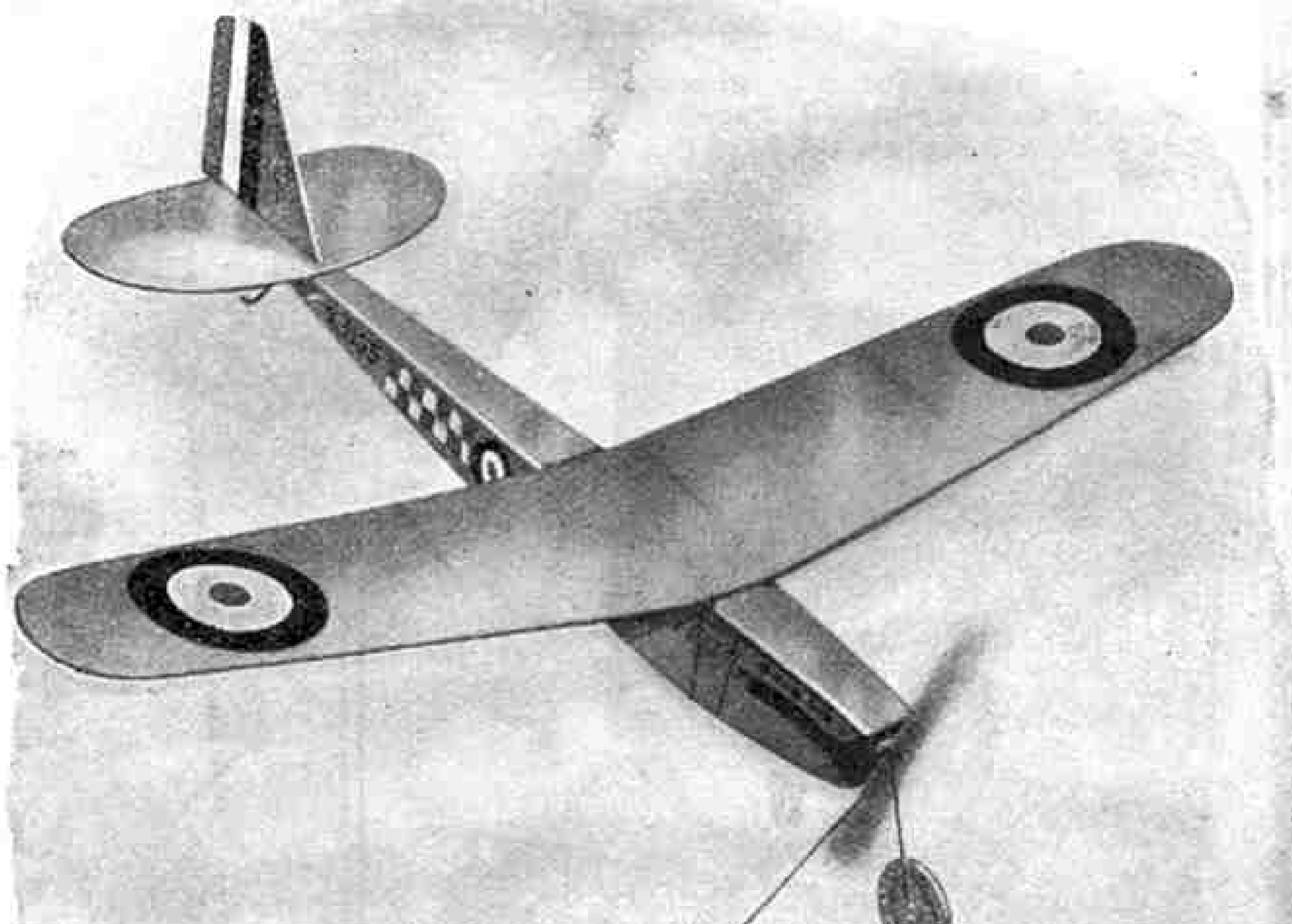
World's Patents Granted and Pending

A handsome flying scale model of the famous De Havilland light aeroplane on which many records were broken. Every detail has been perfectly reproduced. The fuselage is of all metal construction. Each wing is attached to the fuselage with the PATENT FROG QUICK DETACHABLE FITTINGS, thus minimising the risk of damage. A powerful dual motor is coupled to a step up gear box. The undercarriage is of a special shock-absorbing type and the cabin and roof lights are realistically fitted with transparent celluloid. After a little experience flights of 600 ft. or more can be obtained. **17/6**



THE "MERCURY"

Splendid model of latest type high wing passenger carrying monoplane. Tubular fuselage and spring undercarriage, landing wheels fitted with streamline spats. Imitation radial motor with Townend ring. Carved airscrew. The whole model is attractively finished in colours, and with practice, flights of 600 ft. can be obtained. WING SPAN 22 ins. Will rise off the ground. **17/6**



THE "METEOR"

A fine new model with exceptional performance, robust construction and handsome appearance. Wings, fuselage and tail unit, aluminium finish. NOTE THE SIZE. WING SPAN 18½ ins. FLIES 300 ft. Will rise off the ground. **5/-**

Write to us for particulars of the FROG Club and handsome Coloured Folder showing the complete FROG Range.

Designed and made by International Model Aircraft Ltd., London, S.W.19

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FROG FLYING SCALE MODEL AIRCRAFT

THE WORLD-FAMOUS

HAWKER "HART" MK. II DAY BOMBER

FROG
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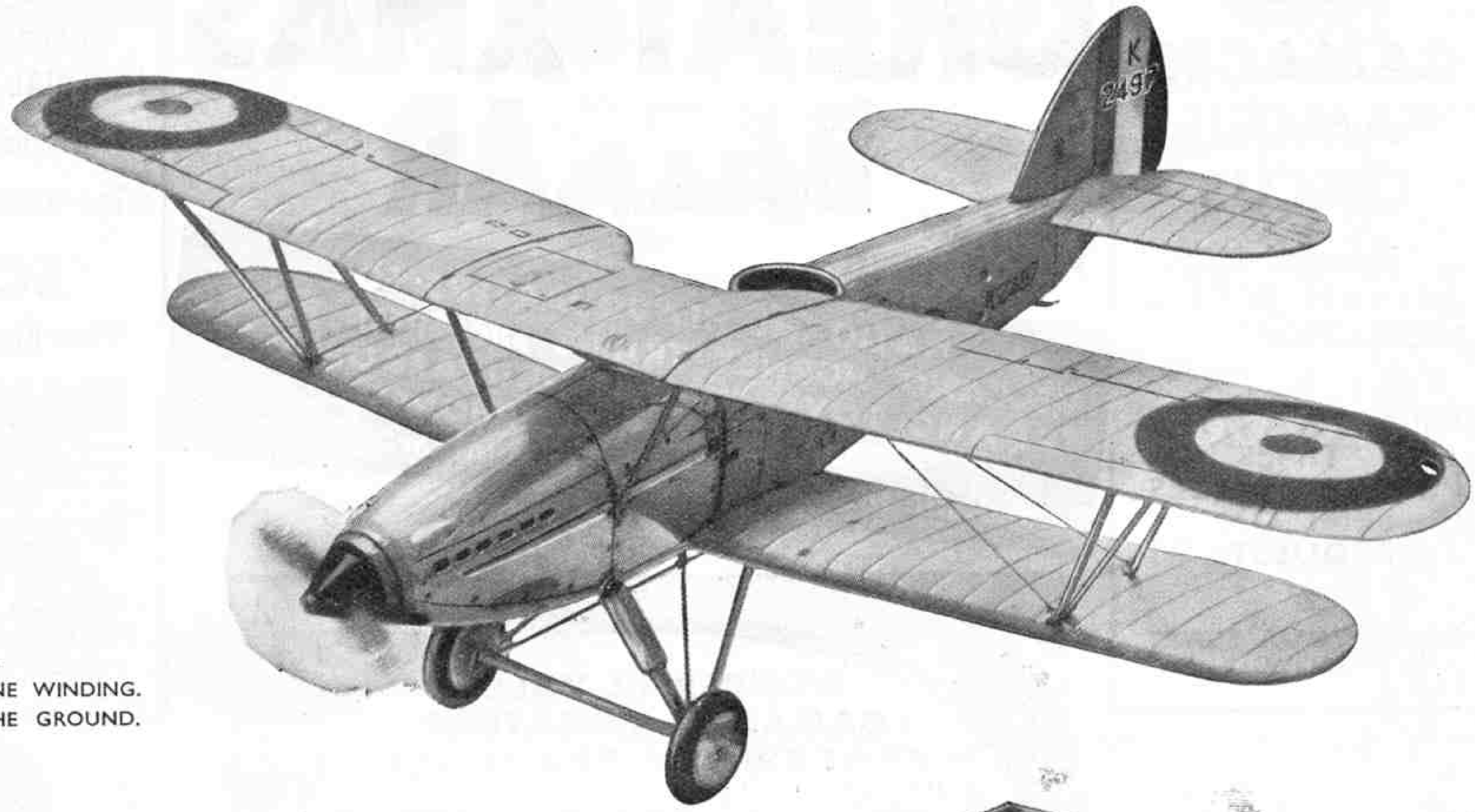


WING SPAN 18¾ ins.
FLIES 750 ft. AT ONE WINDING.
WILL RISE OFF THE GROUND.

Actual scale reproduction of the famous R.A.F. High Speed Day Bomber, the **first flying scale model biplane** ever made. It is made with the accuracy of a scientific instrument and has real aircraft type construction. The pilot's cockpit is fitted with a dummy instrument board and the observer's, with a gun-mounting ring. When the controls have been mastered and the necessary skill acquired, the model is capable of some remarkable flights, and will fly 750 ft. at one winding. It is controlled by rudder and elevators, just like a real aeroplane.

42/-

Complete with extra strong container box, fitted with PATENT HIGH SPEED WINDER. One set of spare motors, lubricant, gear box oil, triple insertor rod, and fully illustrated flying manual. →

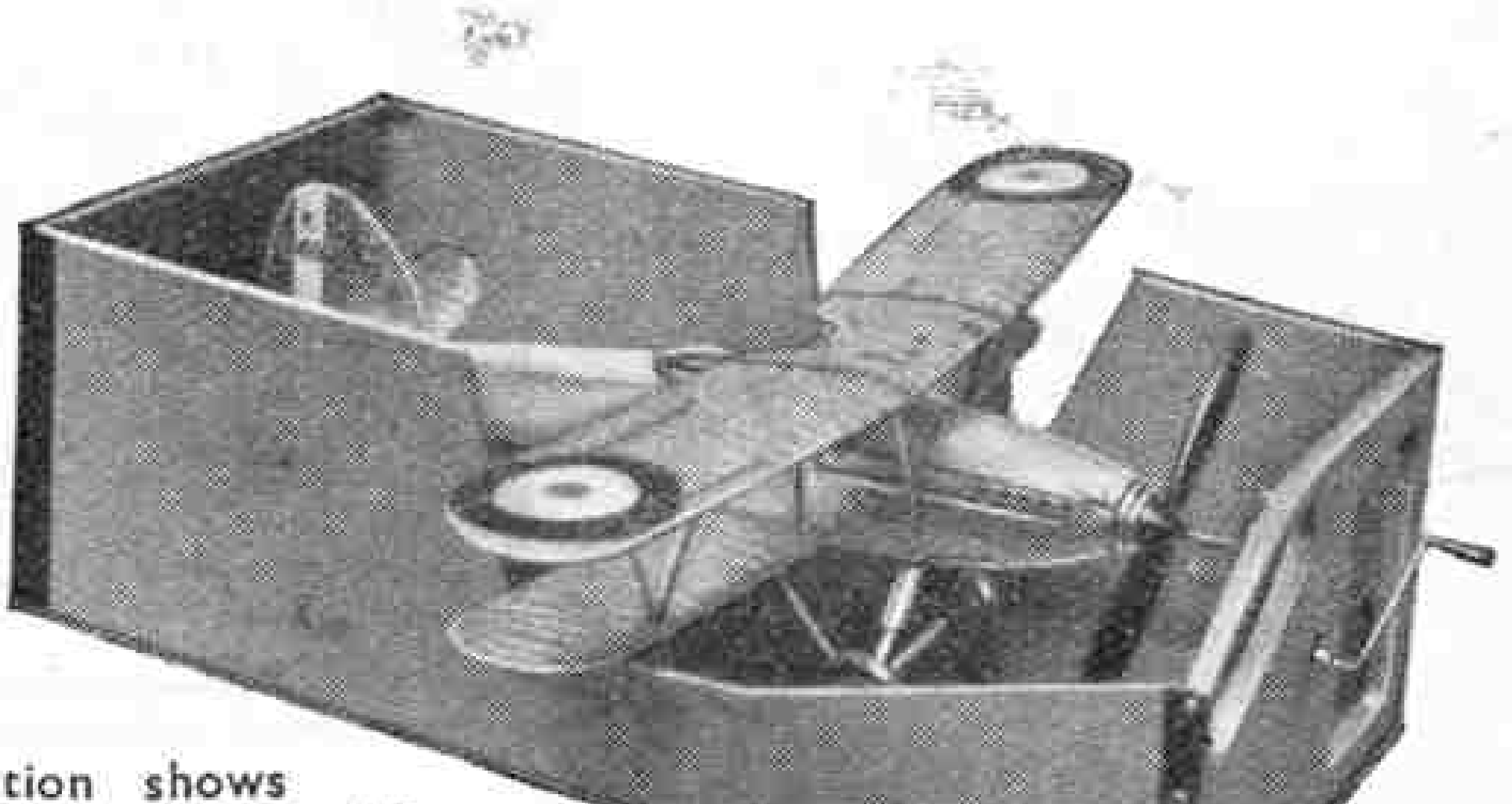
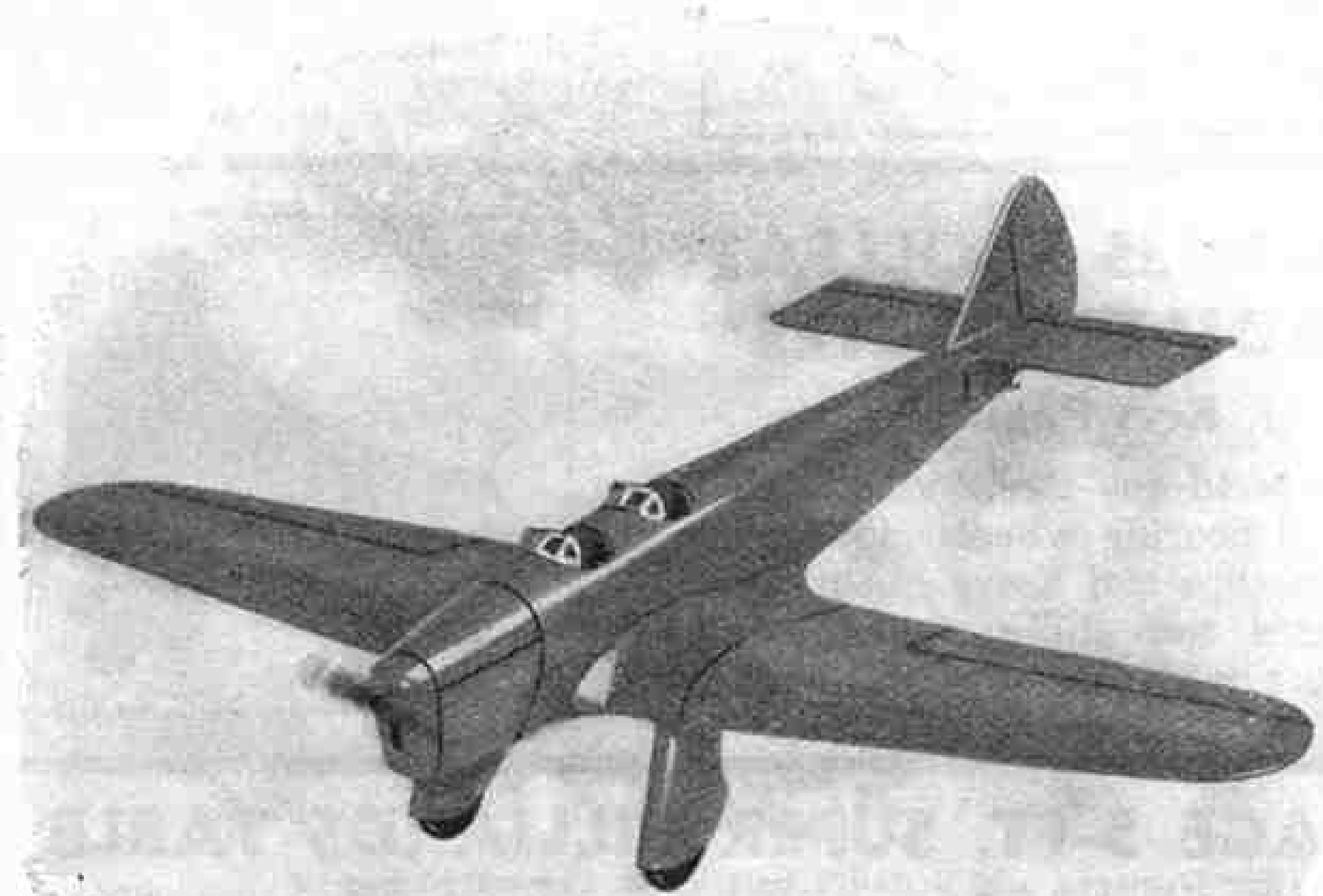


Illustration shows how quickly this model is wound for flight with the Winder Box. A PATENT AND EXCLUSIVE 'FROG' FEATURE.

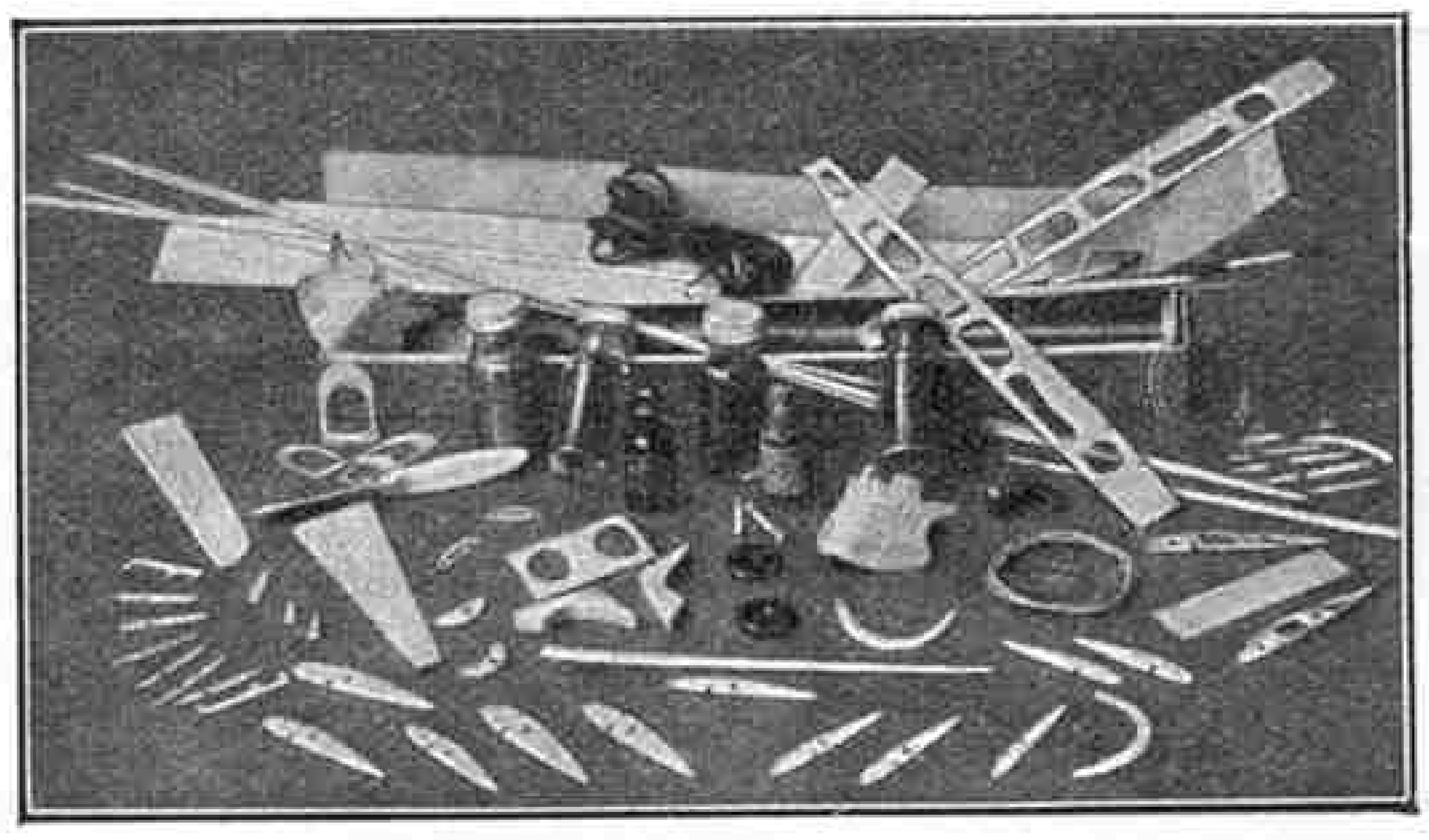
The

MILES "HAWK-MAJOR"

HERE IS A SCALE MODEL YOU CAN **CONSTRUCT YOURSELF**



ACTUAL PHOTOGRAPH OF FINISHED MODEL.



THE MILES "HAWK MAJOR" CONSTRUCTIONAL KIT

An easily assembled kit for constructing a flying scale model of this famous record breaking light Aeroplane SUPPLIED COMPLETE WITH ALL IMPORTANT PARTS BLANKED OUT. Full instructions with step by step instruction sheet. Finished airscrew and step up gear box, aluminium wheels and windshields. Wing span 16½ ins. With a little experience flights of 600 ft. are obtainable.

10/6

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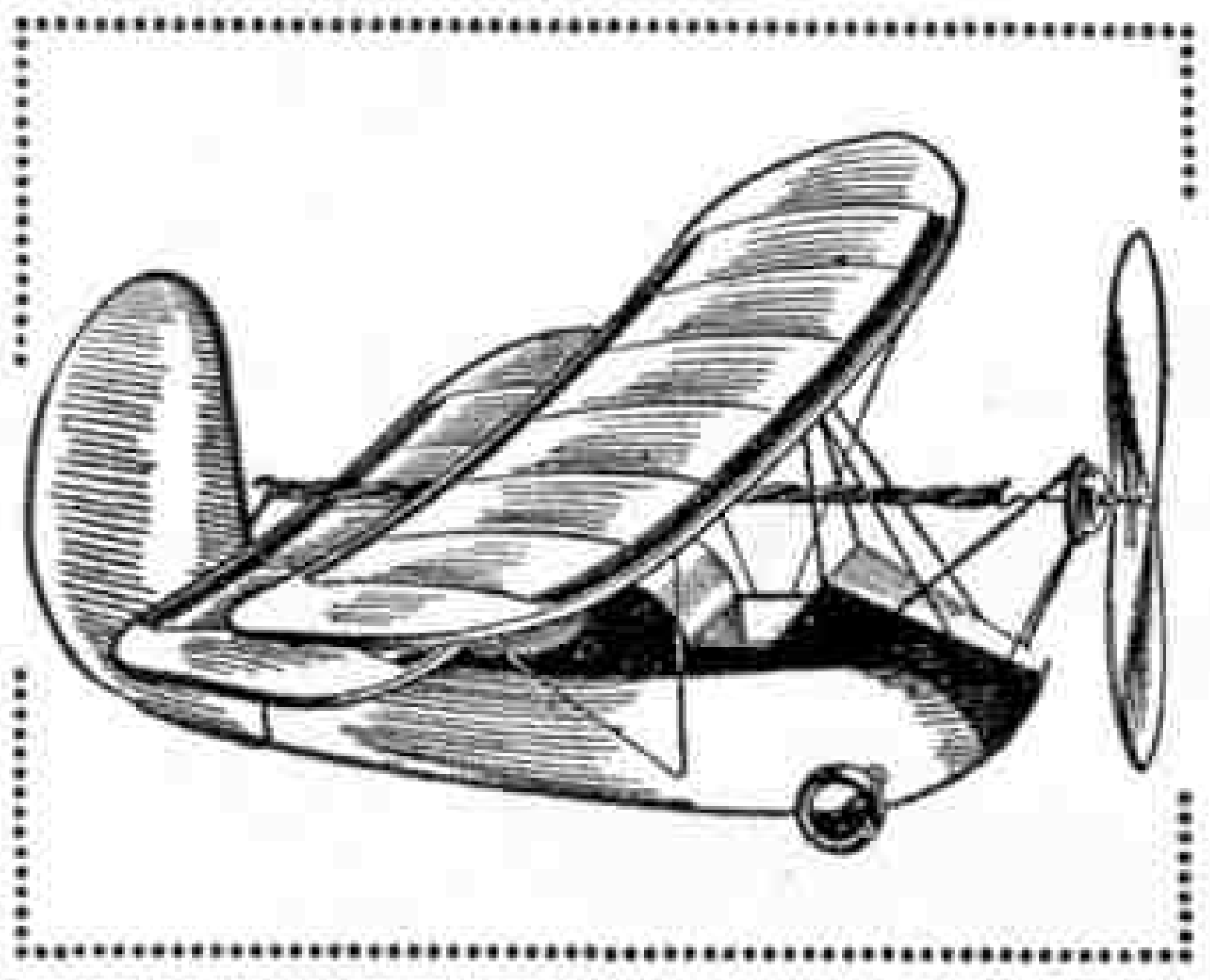
WONDERFUL VALUE GAMAGES MINIATURE CLOCKWORK TRAIN SET

GAUGE "OO." The advantage of the 'OO' gauge is that a comprehensive model railway system can be built up in a comparatively small space. The set comprises strong locomotive with brake in cab, and brake action from the track, two passenger coaches and luggage van, signal box, two signals, tunnel, station, and circular track (twelve rails—one fitted with brake lever).

Price complete **12/6** Post 9d



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Boys! Make your own **FLYING MODEL** of Mignet's famous "Flying Flea" Baby Aeroplane. Easily constructed from self-locking parts and complete with detailed chart and full instructions for easy and accurate assembly without tools.

EASY TO BUILD—GUARANTEED TO FLY. Complete **3/6**

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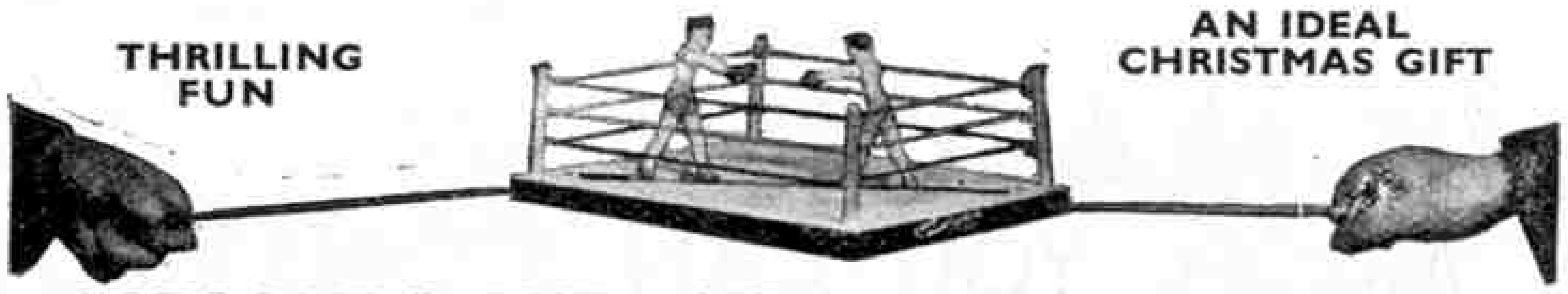

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A real novelty in a boxing game. The excitement of a big fight in your own home! The boxers are operated by means of pressure on air bulbs. The best man wins! Post 6d. Price **15/-**

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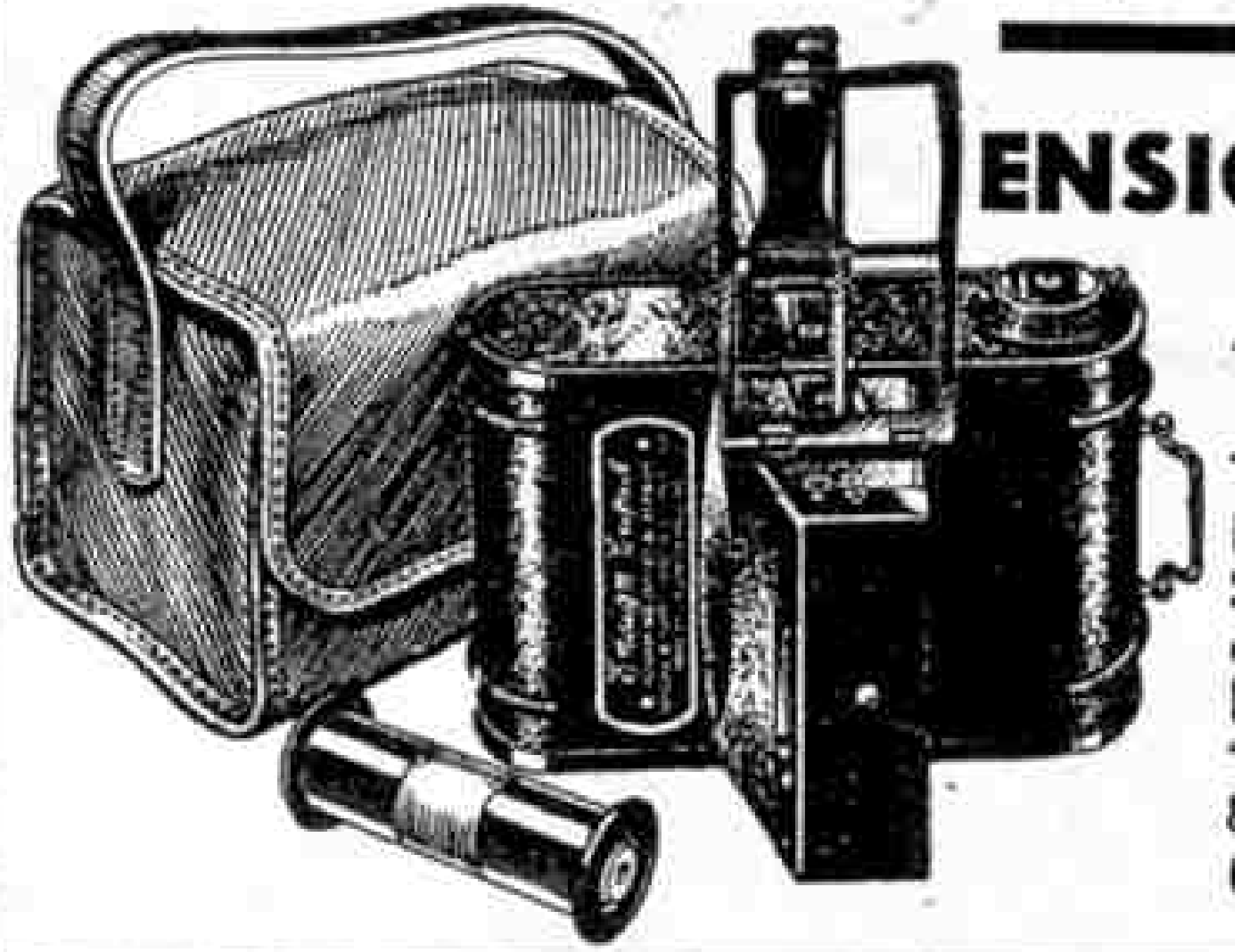
Made to sell at 10/- each. A transformer is fitted in the base, making it very simple to operate. You simply connect the front terminals on the microphone to Pick-Up terminals on your Radio Set and the back terminals on the microphone to an ordinary 2-4 volt battery. Complete with instructions. Battery 4d. extra. Post 6d. **3/11**



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Originally Listed alone at 21/-, now with WATERPROOF CASE AND ROLL OF FILM FOR FIVE SHILLINGS. This beautifully constructed little camera is fitted with rapid lens, special T. & I. Shutter with safety catch, and latest type collapsible direct vision view-finder. Particularly economical to use, as it takes 16 pictures on a standard 8 exposure 2¼ x 3¼ spool (1/-). **Complete Outfit** Post 6d. **5/-**

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Send for Gamages Billiards and Table Tennis lists.

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Size of table	Length of cues	Diam. of balls	
4 ft.	3 ft. 6 in.	1⅜ in.	**35/-**
*3 ft. 6 in.	3 ft.	1¼ in.	**23/6**
*3 ft.	3 ft.	1⅛ in.	**19/6**

**The last two tables have slightly cheaper quality cloth.*

SNOOKER SET.—17 balls and triangle, suitable for 5 ft. table **20/-**

Book of Official Rules of Snooker or Billiards **1/-**

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This model weighs less than 1 oz. and has an amazing performance, yet is strong enough to withstand hard knocks. Finest machine ever produced at the price: Span 15″. Flying speed 1,098 ft. per min. Distance 550 ft. Ceiling 40 ft. **2/6** complete

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For long-distance flying and ease of control, this machine is unbeatable: Span 26½″. Flying speed 1,230 ft. per min. Distance 1,127 ft. Ceiling 80 ft. **10/6** complete

"MOTH"

Now reduced to 3/6 it represents the highest value ever offered in model aircraft. A really fine flyer and beautifully finished: Span 18½″. Flying speed 1,320 ft. per min. Distance 700 ft. Ceiling 50 ft. **3/6** complete

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A superb new fuselage model of a fighter aircraft with correct colours and markings: Span 18½″. Flying speed 1,230 ft. per min. Distance 300 ft. Ceiling 30 ft. **5/6** complete

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For long duration flights. Weight ratio is reduced to a minimum in this model to give the utmost duration of flight: Span 20″. Flying speed 1,098 ft. per min. Distance 800 ft. Ceiling 60 ft. **4/6** complete

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The monoplane with an exceptional performance. The best model for stunting—loops, rolls, banked turns, etc.: Span 23″. Flying speed 1,410 ft. per min. Distance 900 ft. Ceiling 80 ft. **7/6** complete

THE WARNEFORD "PARA-SHOOTER"
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Designed on new principles it is blown from a tube and makes a most realistic descent. Price **1/-**

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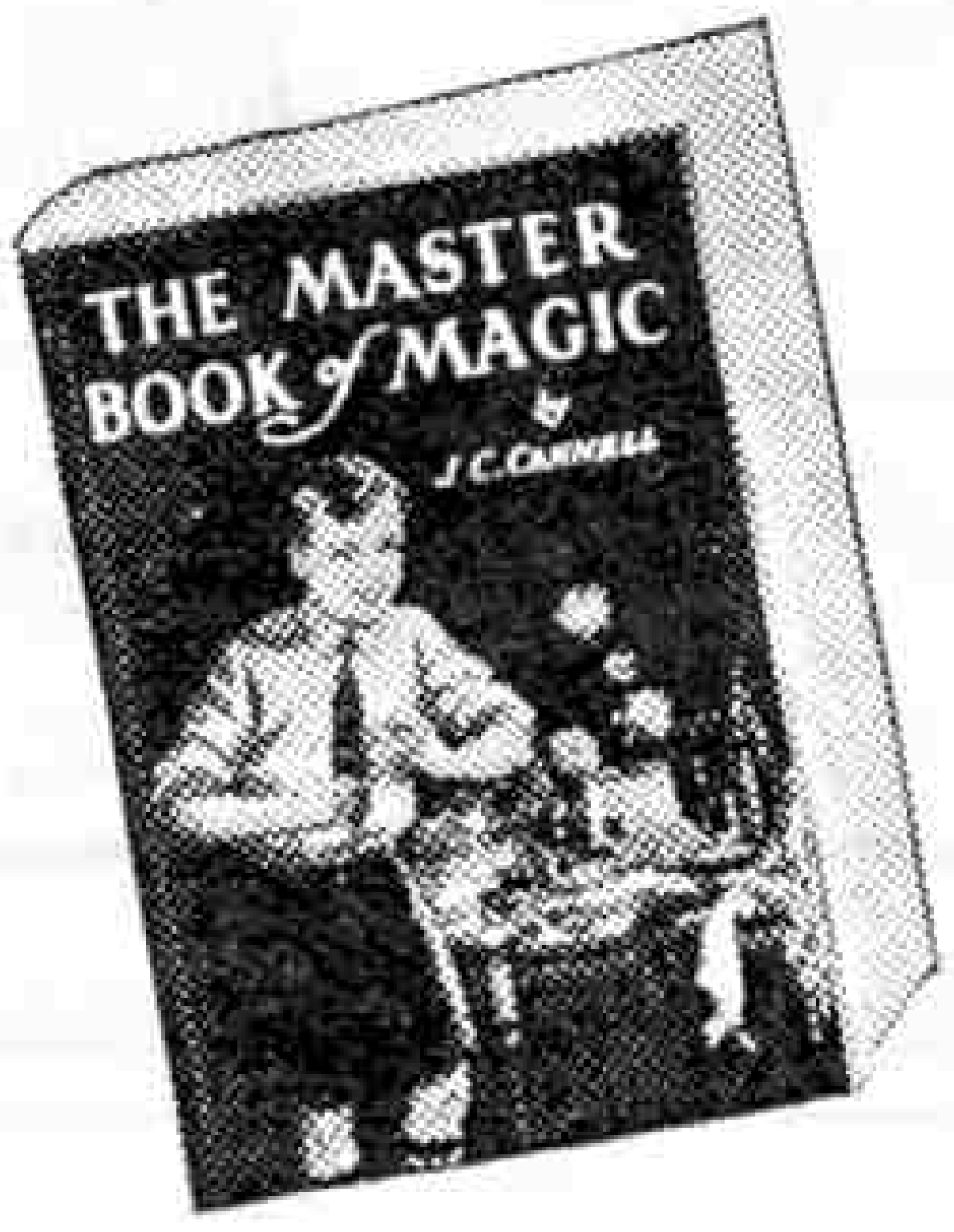
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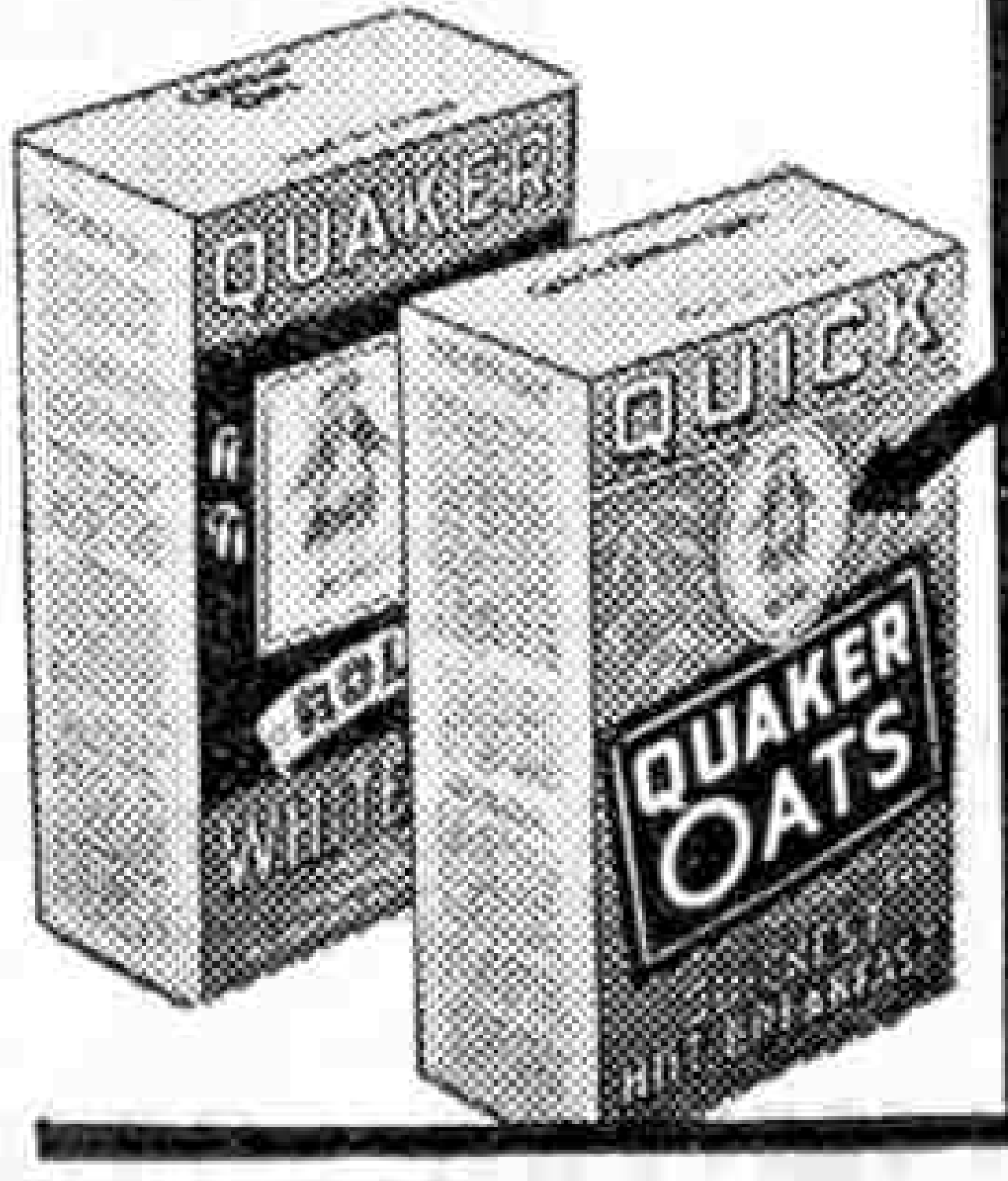

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See these fine ASTRA Electrical Toys
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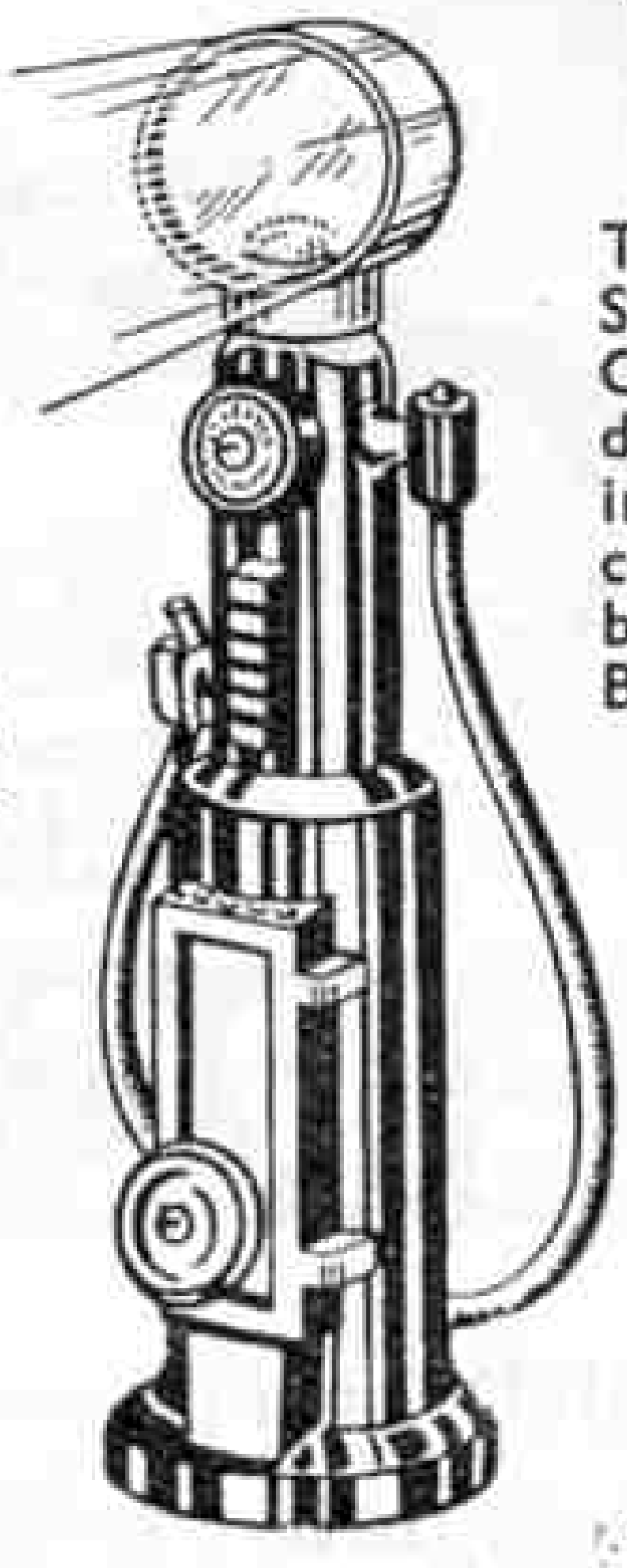
TRAFFIC LIGHT

Two-light Railway or Traffic Signal. Height 6¾". Complete with standard battery housed in stem and switch controlling red and green lights. Black finish.
Price **2/11**

SEARCHLIGHTS

This model is 5" high, throws a powerful beam of light adjustable through any angle. Complete with switch, bulb and battery housed in case finished battleship grey.
Price **3/11**

Mounted on circular platform, a realistic model throwing a very powerful beam for a considerable distance.
Price **5/6**



Price
3/6

TRAFFIC LIGHT

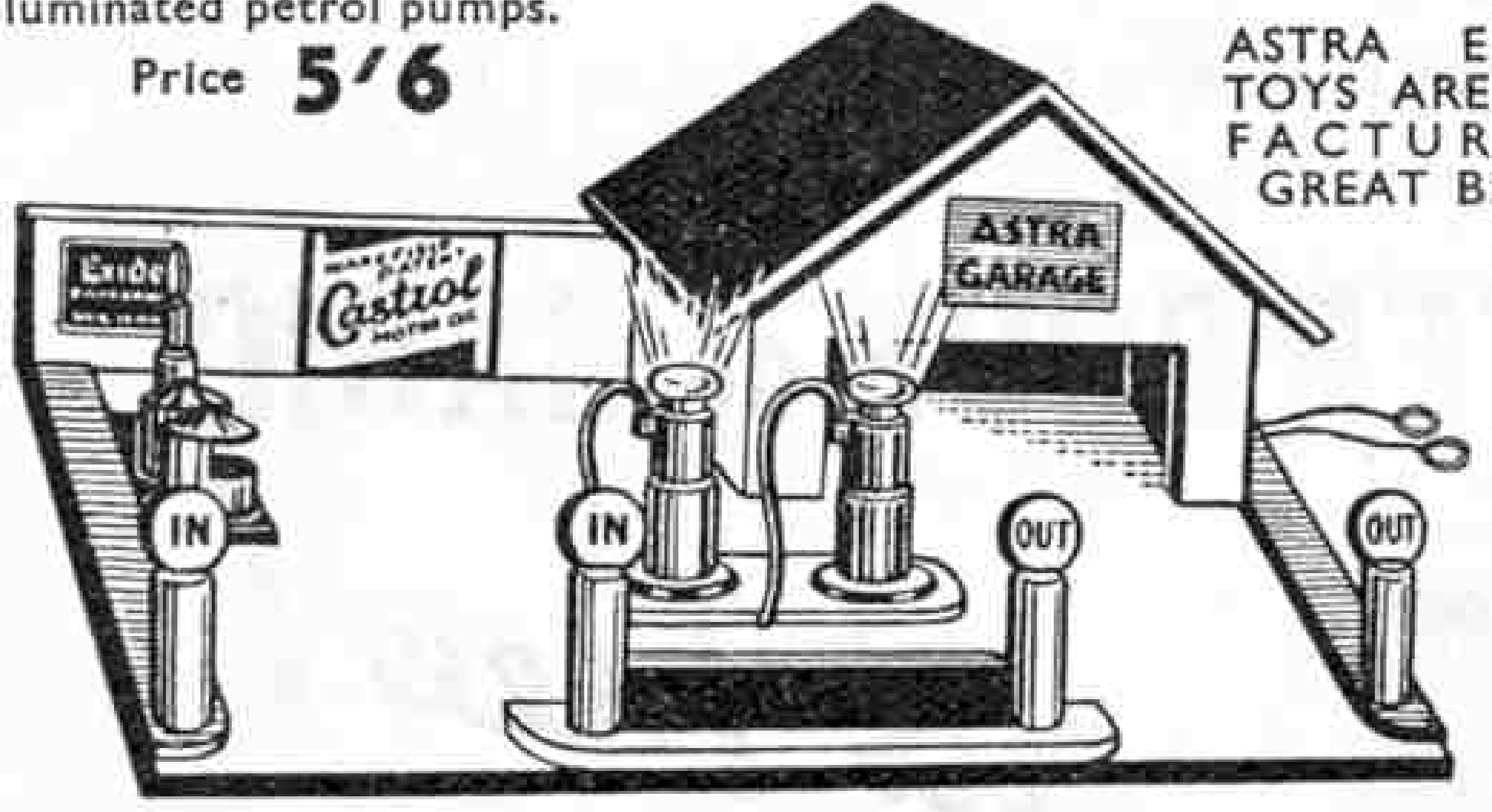
Three-light Traffic Signal. Height 7¾". Complete with standard battery housed in stem and switch controlling red, amber and green light. Black finish.

Price
3/9

PETROL PUMP

Illuminated Pump, 6" high. Complete with bulb and standard battery housed in stem. Rubber feed pipe. Red finish.

GARAGE for Miniature Motor Cars 12"x10". Finished in attractive colours with oil bins and illuminated petrol pumps.
Price **5/6**



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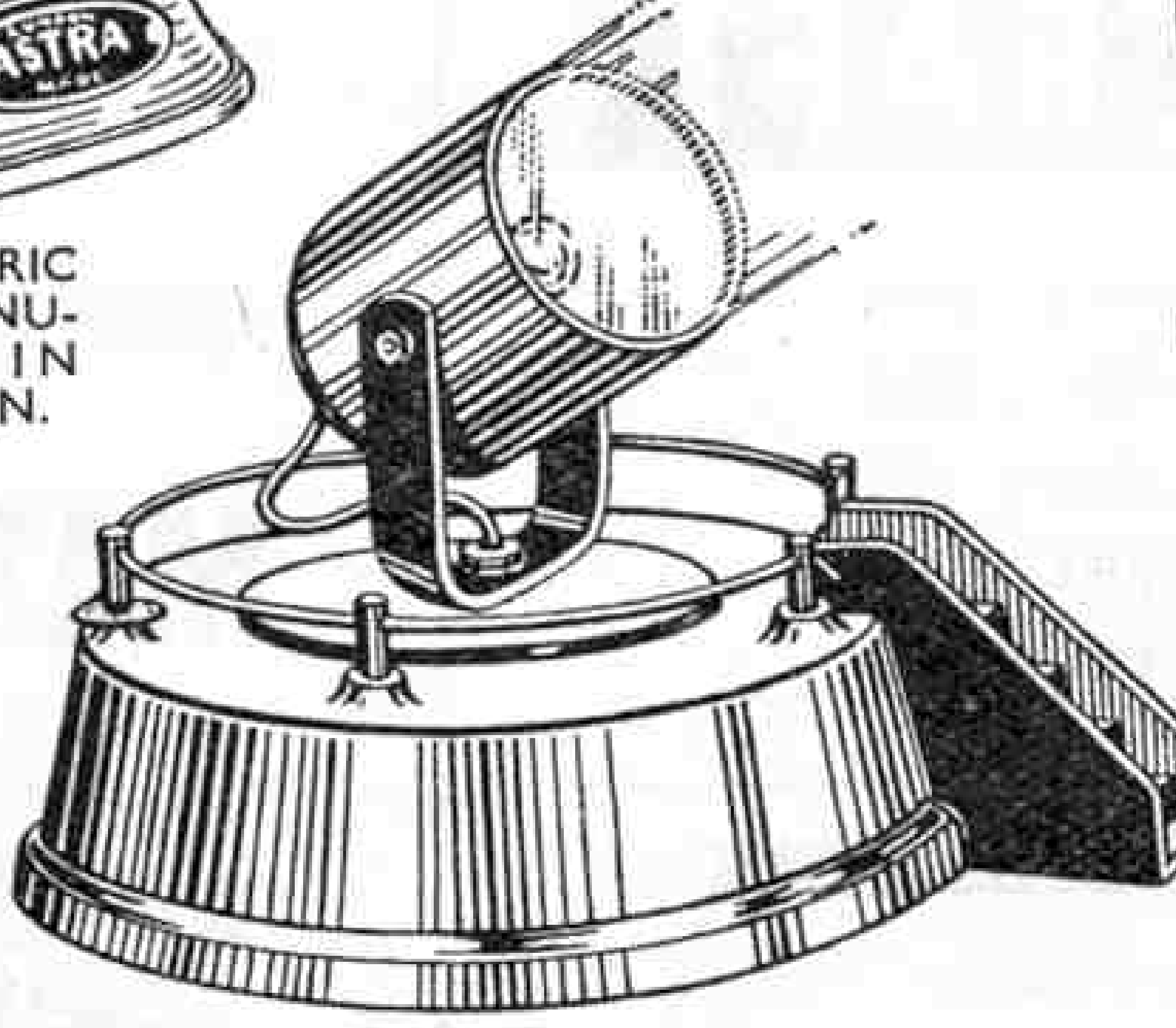

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The most exciting, fascinating and swiftest game of the century

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A splendid game for two people—ideal for three or more players

Mum, Dad and all your Friends will enjoy these Games this Xmas. Arrange "Bourse" and "Nemcol" Parties. Get your Party together and **WIN PRIZES WHILE YOU PLAY**

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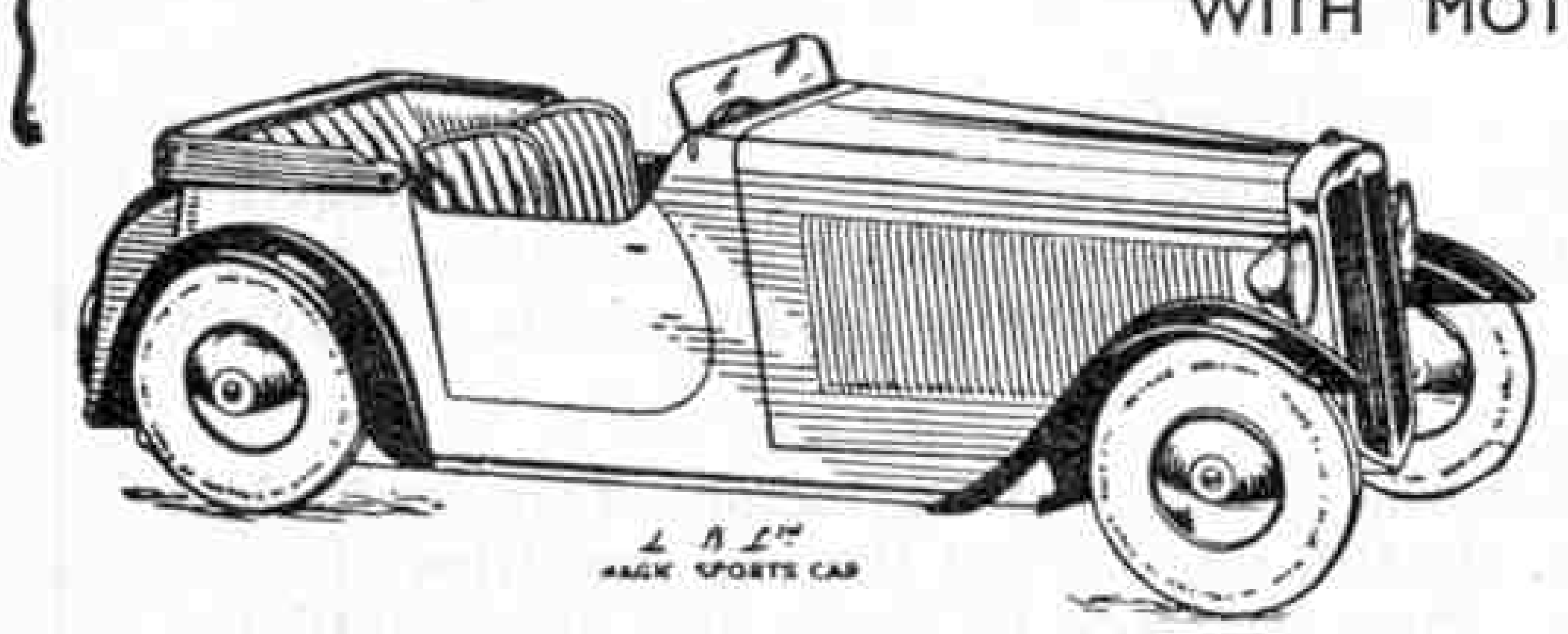
Magic Sports and Saloon Cars

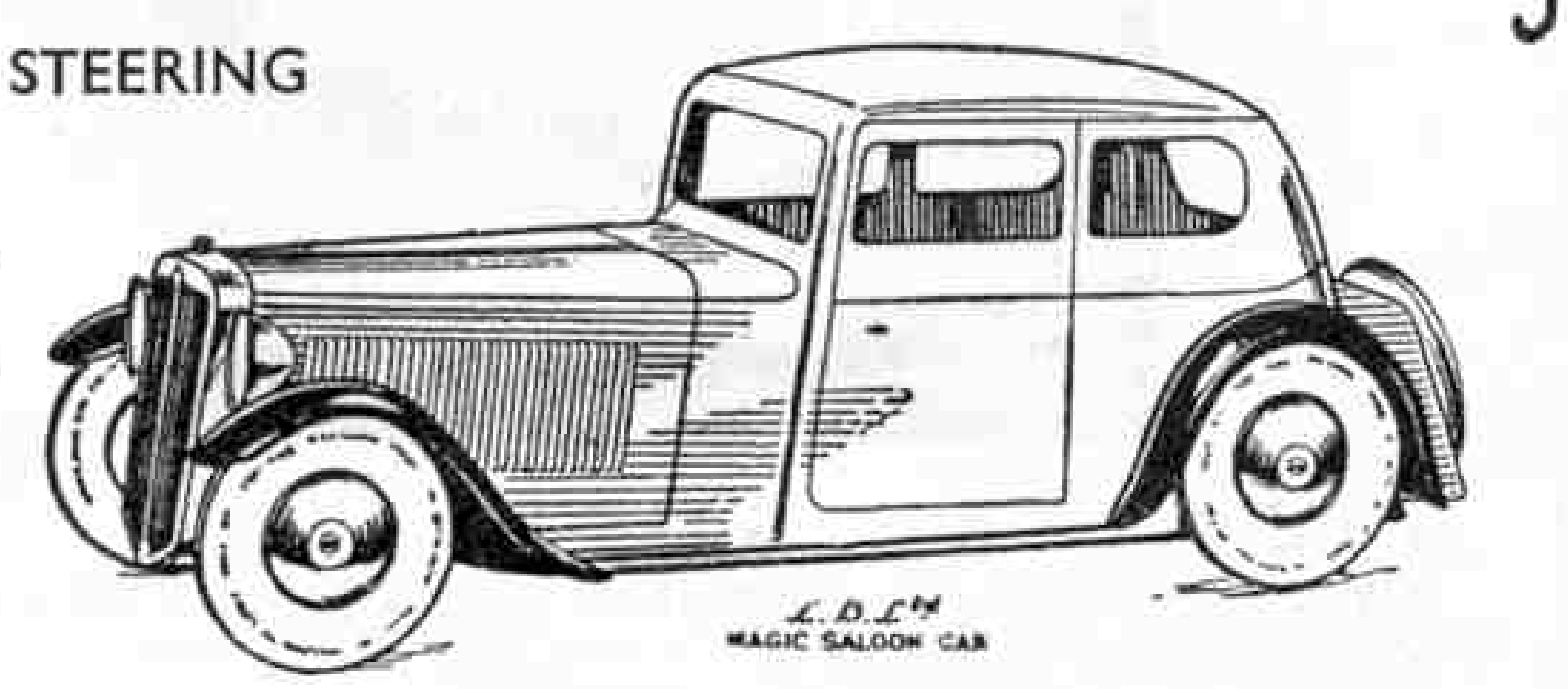
WITH MOTOR TYPE TRANSMISSION AND STEERING

MAGIC SPORTS



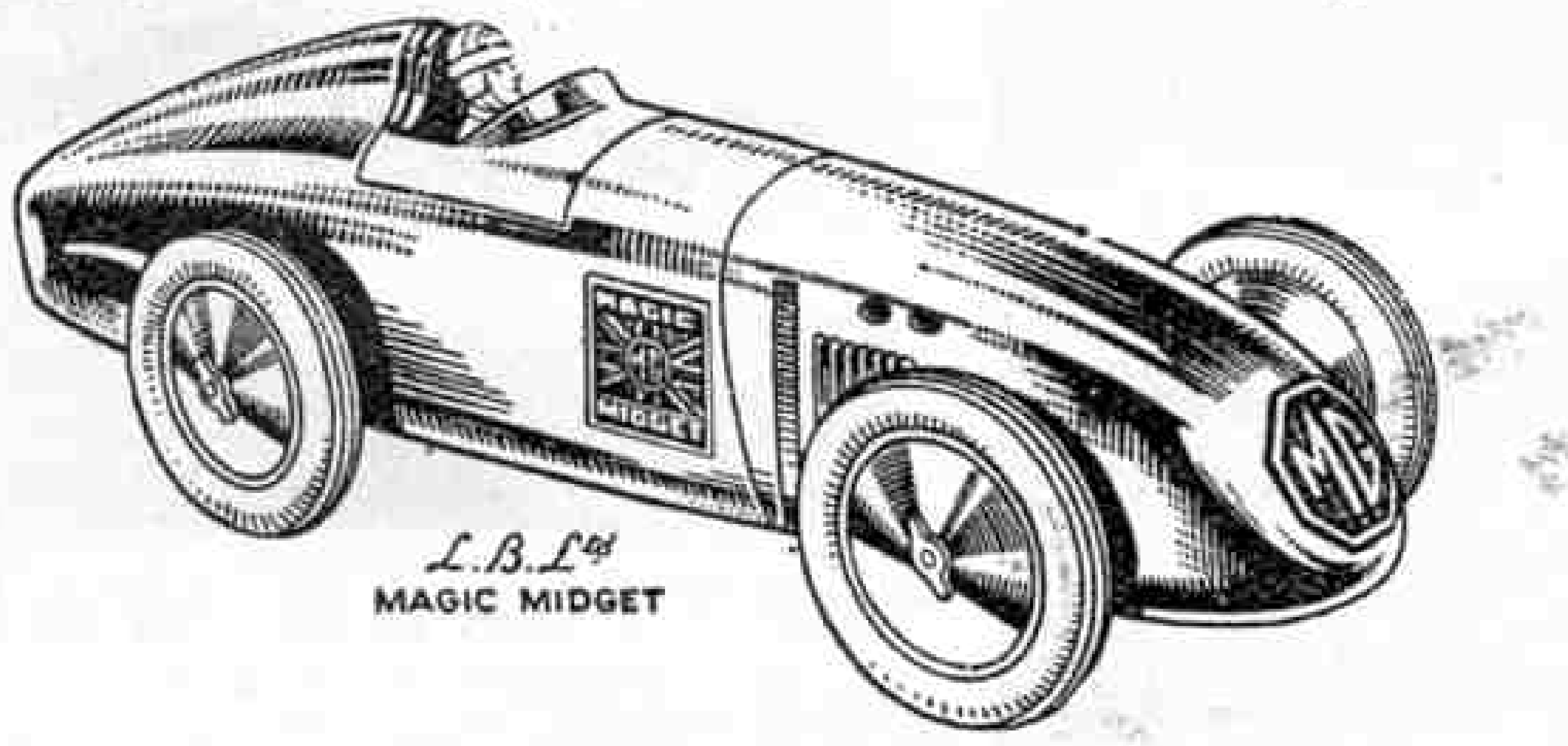
These cars are actually driven with shaft and floating crown-wheel transmission and steered from the driving seat. The steel bodies are replicas of modern automobiles and are fitted with a high speed clockwork motor with stop and start levers. Length 16½ in. Either model price **10/6**

MAGIC SALOON

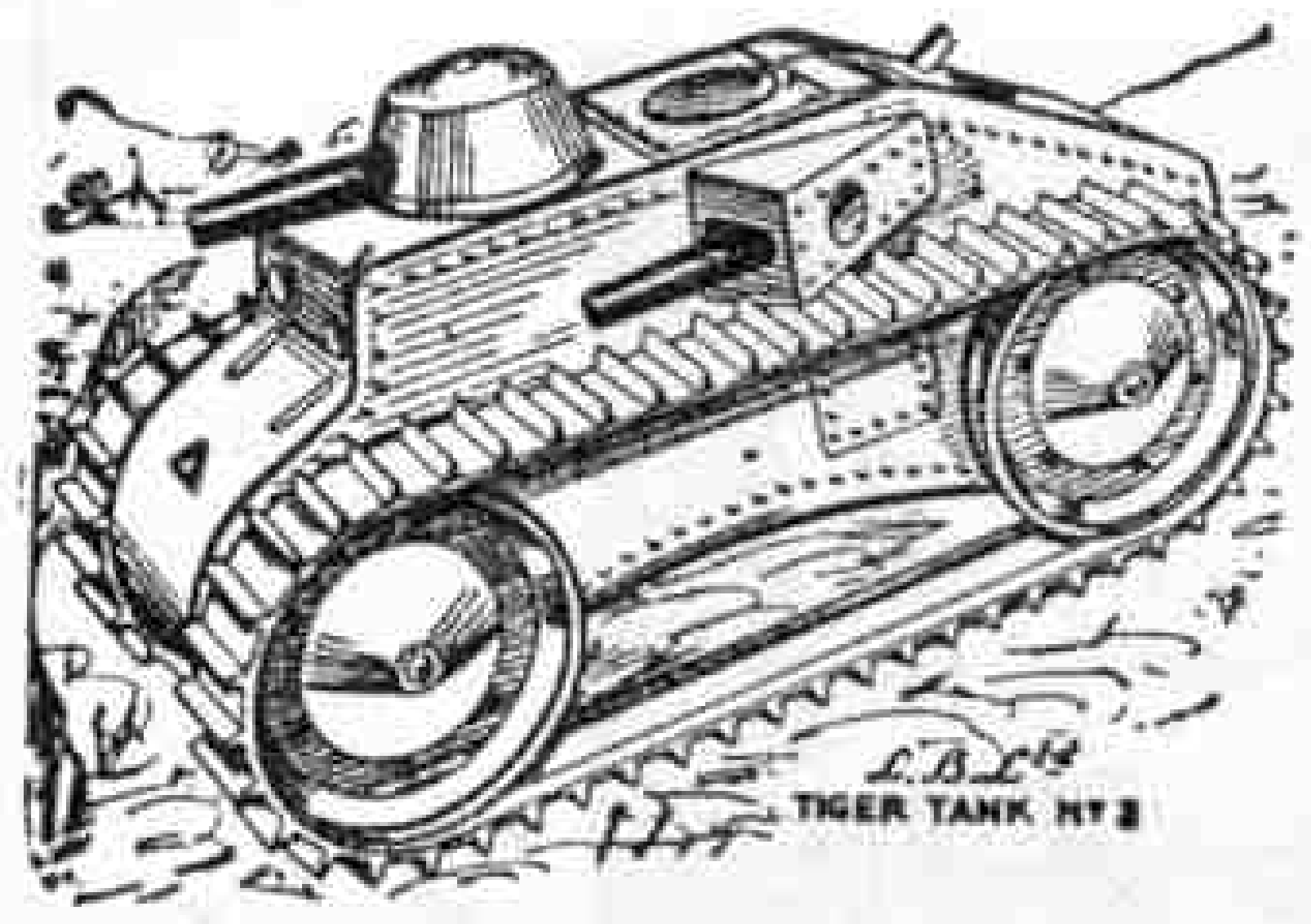


Scale Model of Capt. G. T. EYSTON'S M.G. MAGIC MIDGET

The First Baby Car to do 120 m.p.h.

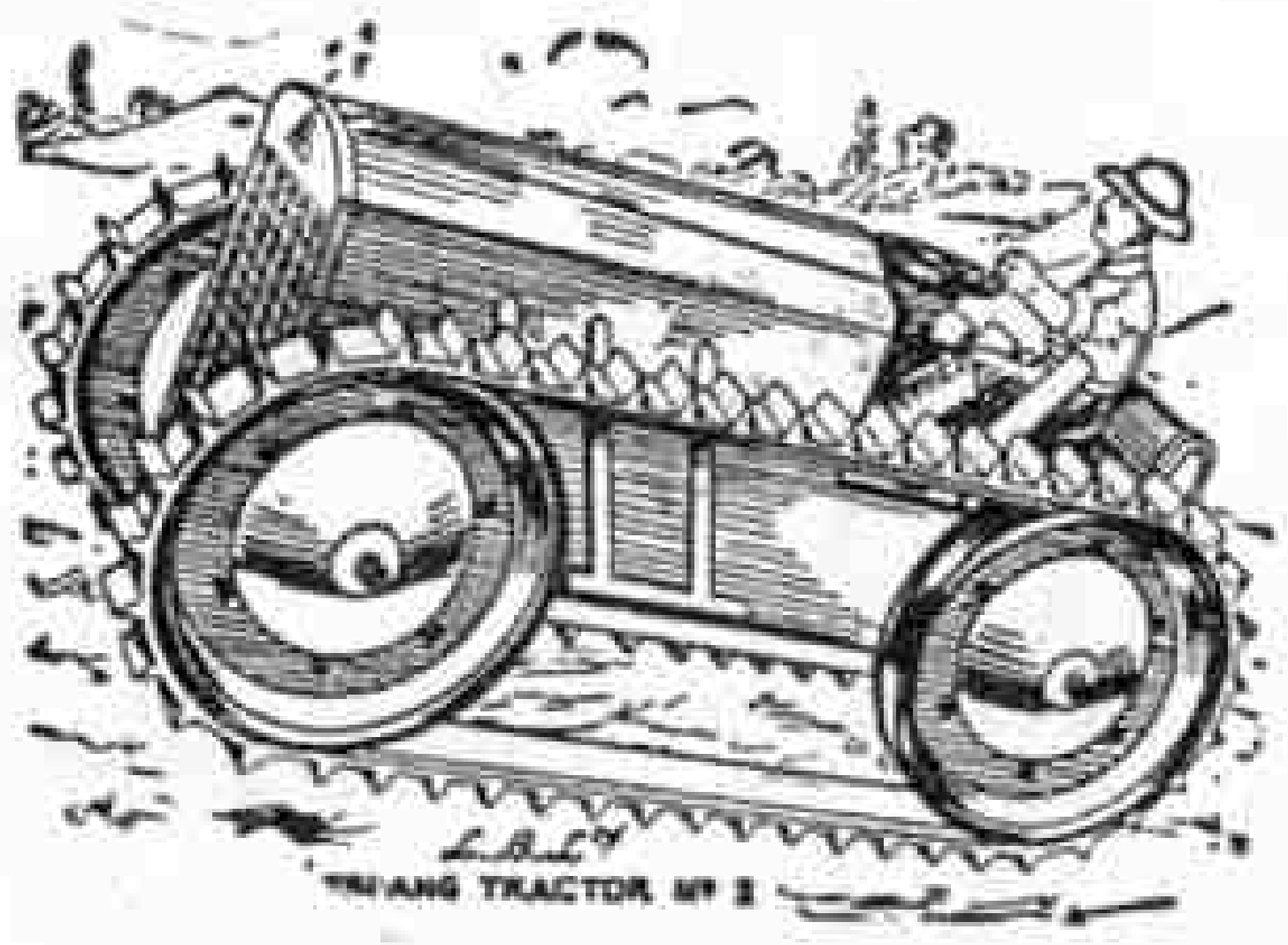


Scale model of the famous record breaking baby car. Steel body, finished green. Powerful clockwork motor. Polished aluminium disc wheels with thick white rubber tyres. Packed in a box with Capt. G. T. Eyston's certificate of authenticity. Length 15⅝ in. **10/6**



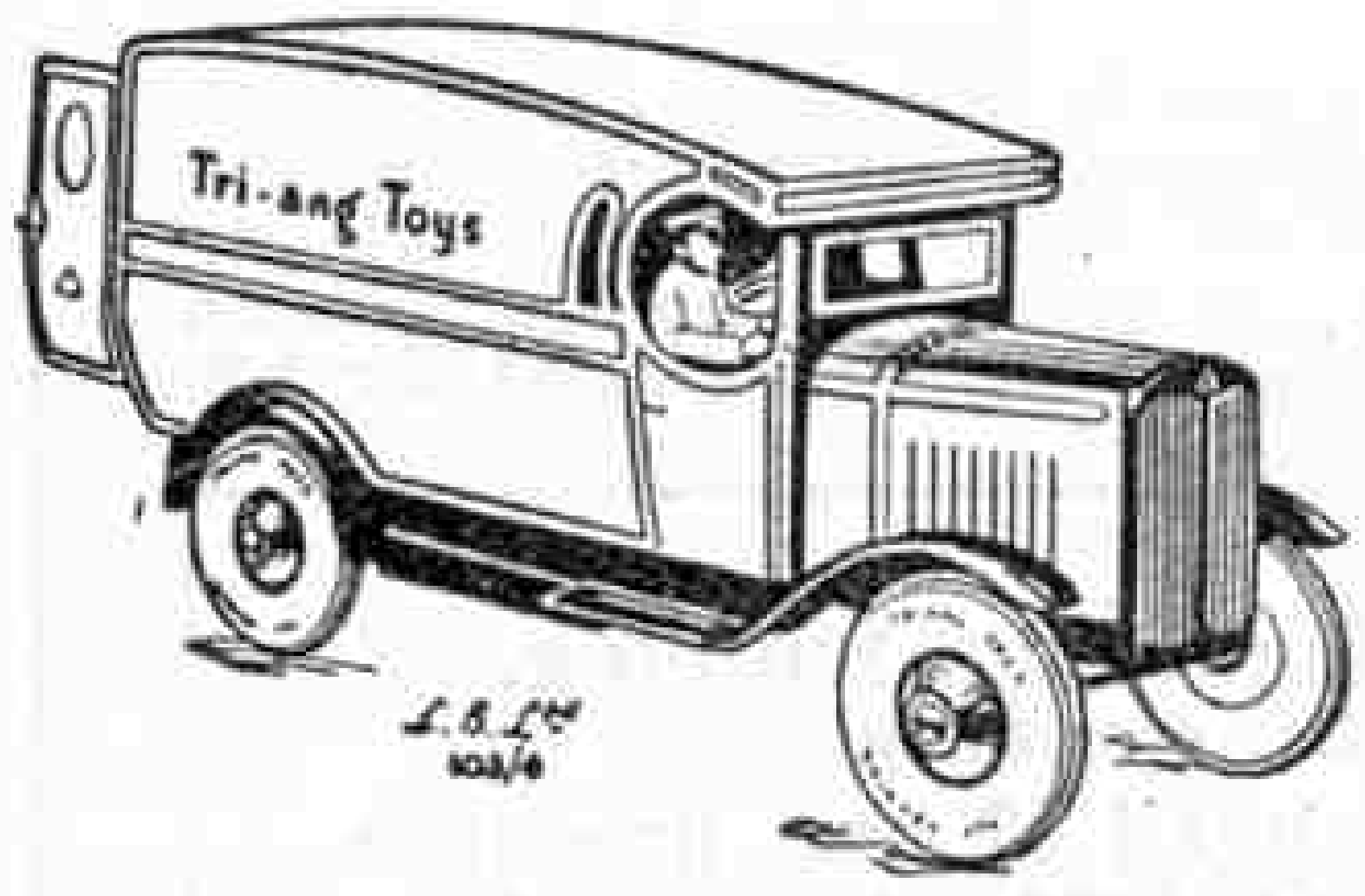
TIGER TANK

A fine model of a heavy fighting Tank. All steel construction with spring-operated gun. Extra strong clockwork. Length 9⅜ in. **4/11**



TRACTOR No. 2

A fine climbing toy with powerful clockwork motor. Steel body and rubber caterpillar bands. Length 8⅝ in. **2/6**



MOTOR DELIVERY VAN 103/4

A smart Motor Van nicely finished and fitted with long-running clockwork. Solid rubber wheels. Length 13½ in. **4/11**
Fitted with Electric Lights 5/11

STEAM BOX VAN

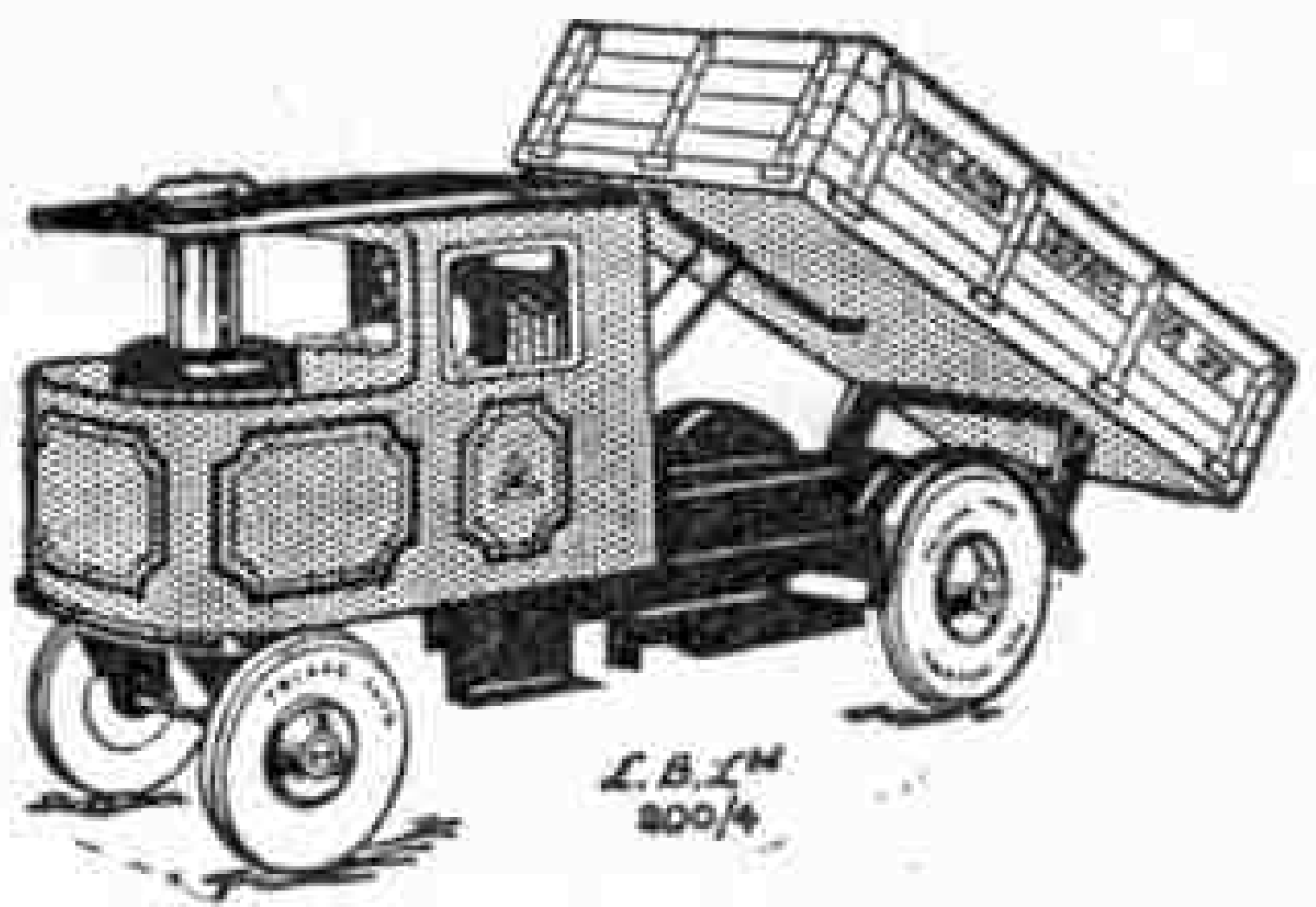
203/4

Similar construction to Motor Delivery Van, but on steam chassis. **4/11**
Length 13½ in.
Fitted with Electric Lights 5/11

MOTOR TIPPING LORRY

100/4

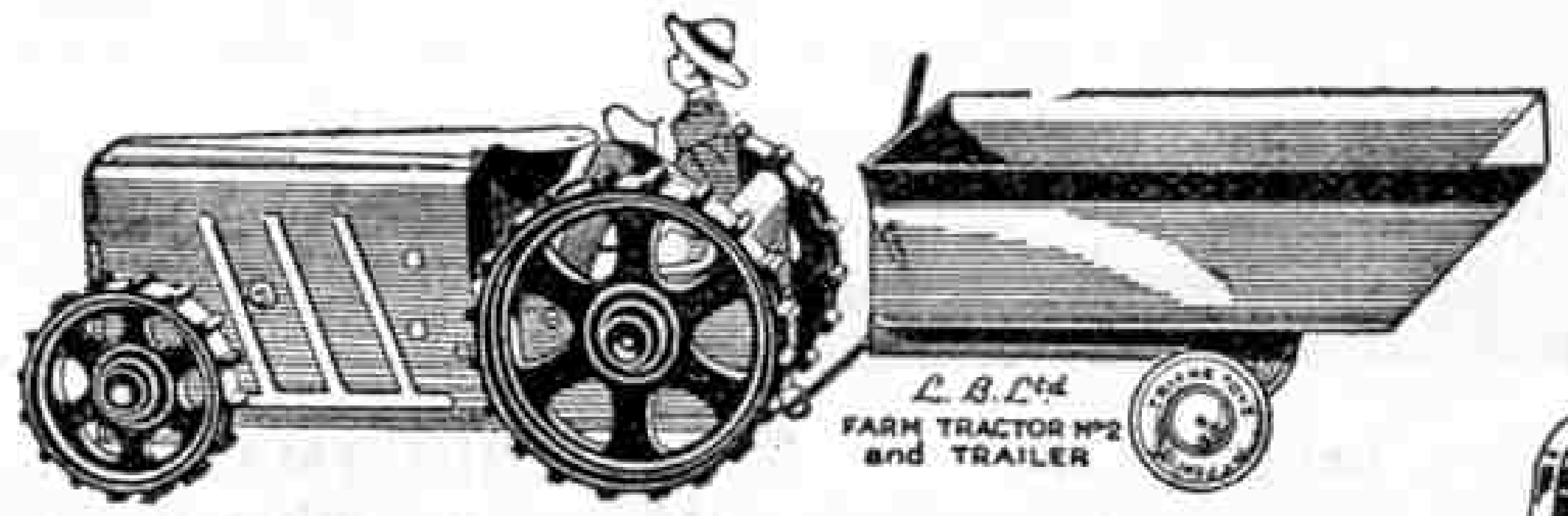
Similar construction to Steam Tip Lorry but on Motor Lorry Chassis. **4/11**
Length 14½ in.
Fitted with Electric Lights 5/11



200/4

STEAM TIPPING WAGON

Well made Steam Wagon of realistic appearance. Tipping body and extra quality clockwork. Solid rubber wheels. Length 13⅜ in. **4/11**
Fitted with Electric Lights 5/11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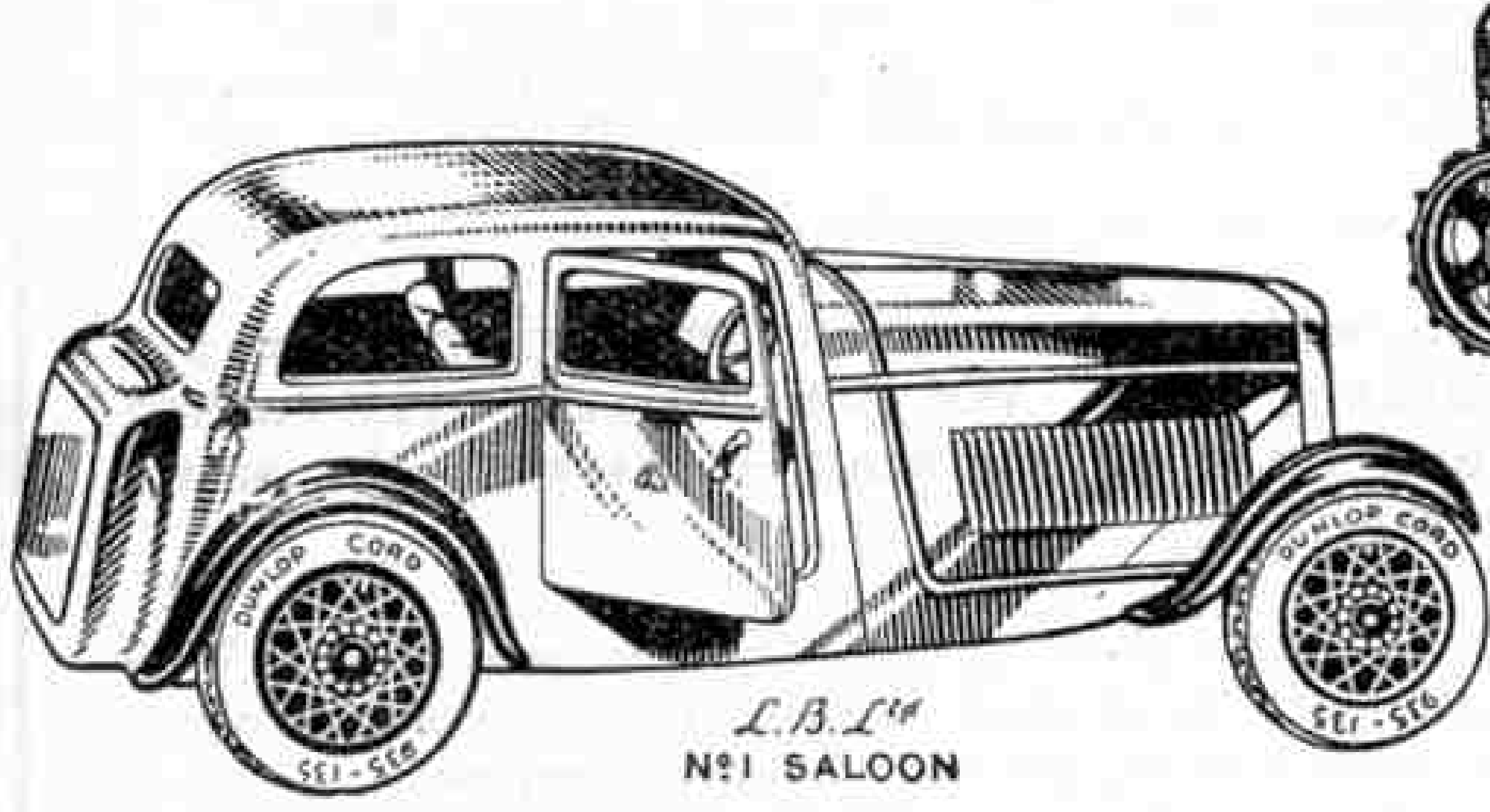
FARM TRACTOR No. 2 and TRAILER

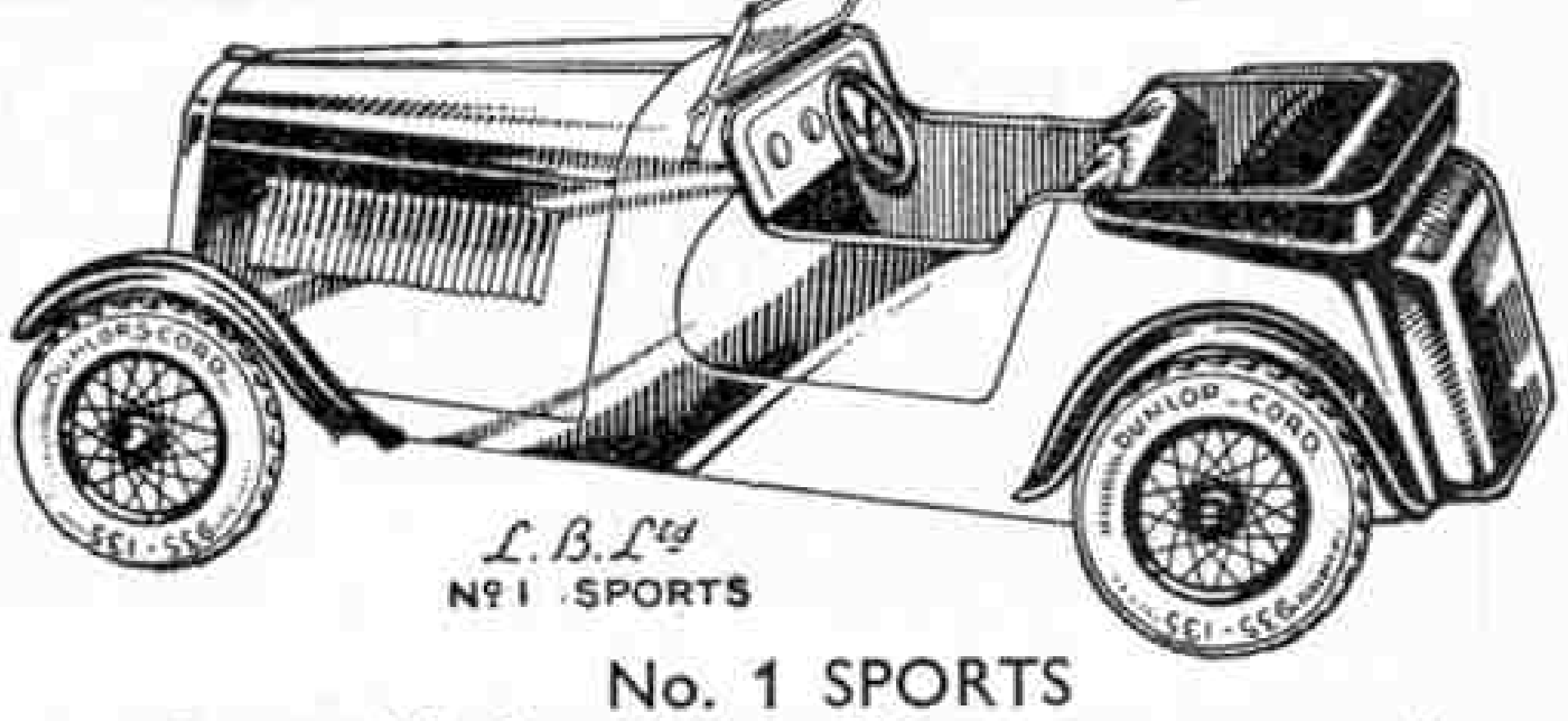
FARM TRACTOR No. 2 AND TRAILER

A powerful Tractor with steel body and heavy rubber wheels. Steel Trailer with tipping body. Overall length 16⅝ in. Tractor only (less Trailer) 2/11 Complete **3/11**



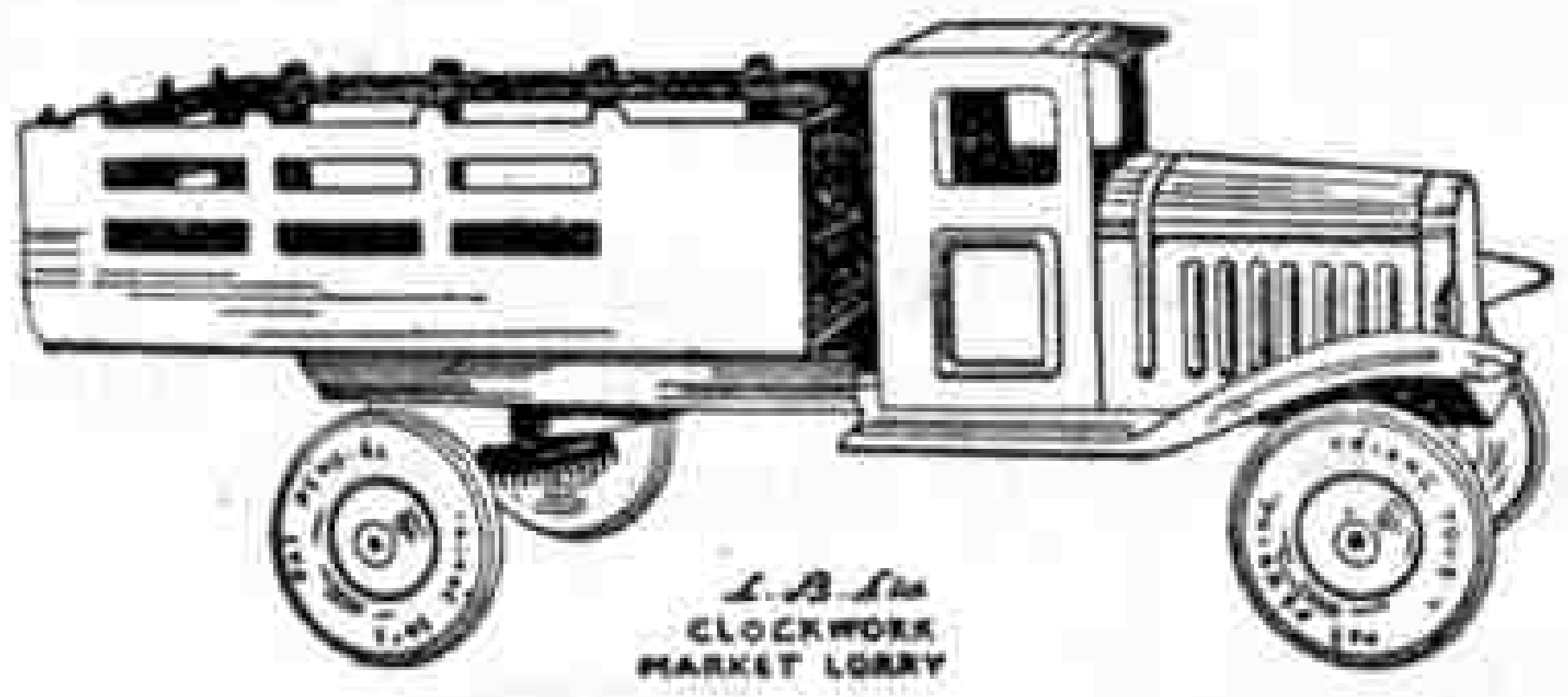
No. 1 SALOON

Graceful appearance, steel body, nicely finished in colour. Powerful long running clockwork motor. Length 16 in. **5/11**
Fitted with Electric Lights 6/11



No. 1 SPORTS

Fine model of a sports car. Very strong construction, steel body, nicely finished in colour. Powerful long running clockwork motor. Length 16 in. **5/11**
Fitted with Electric Lights 6/11



"O" CLOCKWORK MARKET LORRY

Realistic appearance, heavy gauge steel construction. Strong, long running clockwork motor. Solid rubber tyres. Bright finish in colour. Length 12½ in. **3/11**
Fitted with Electric Lights 4/11

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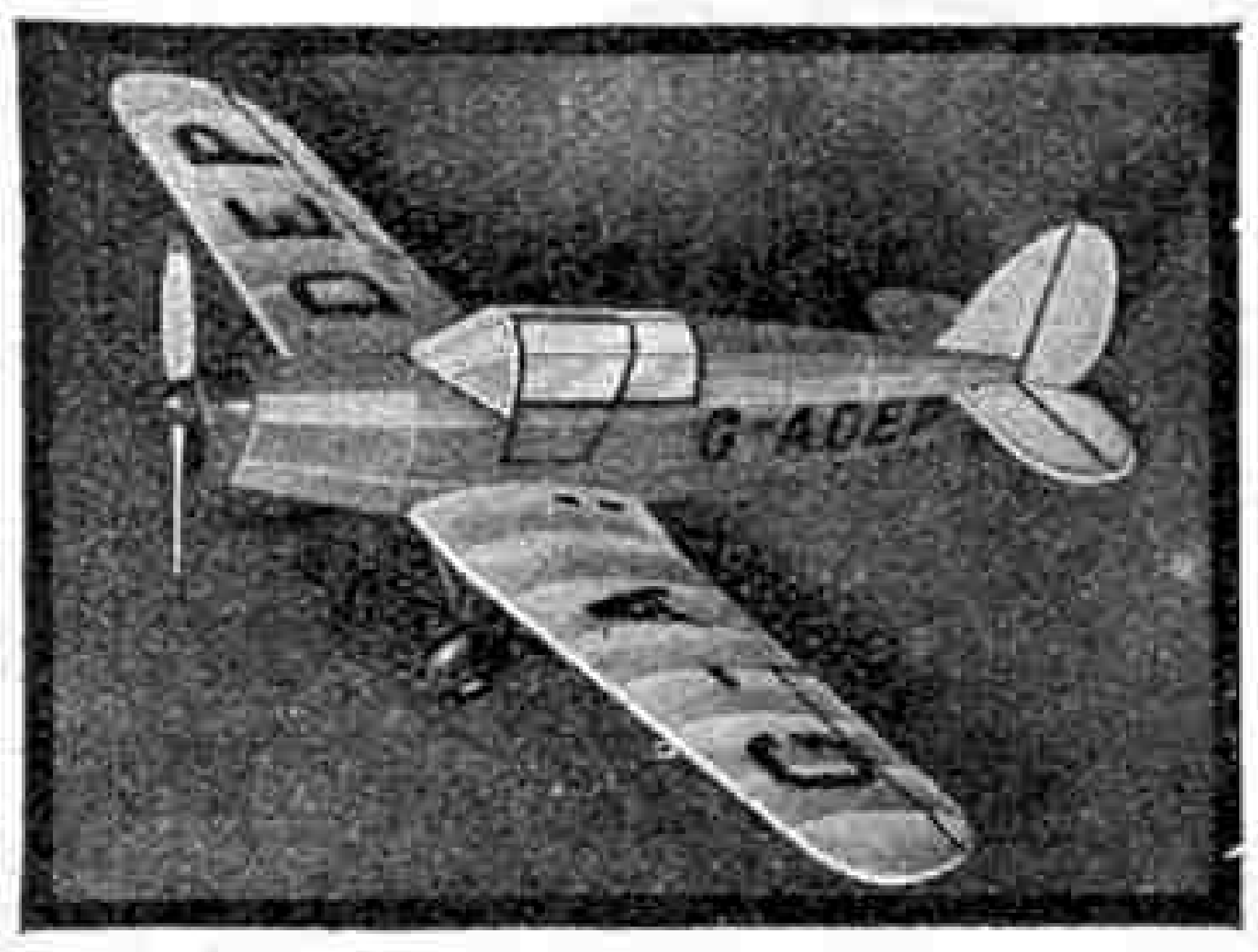


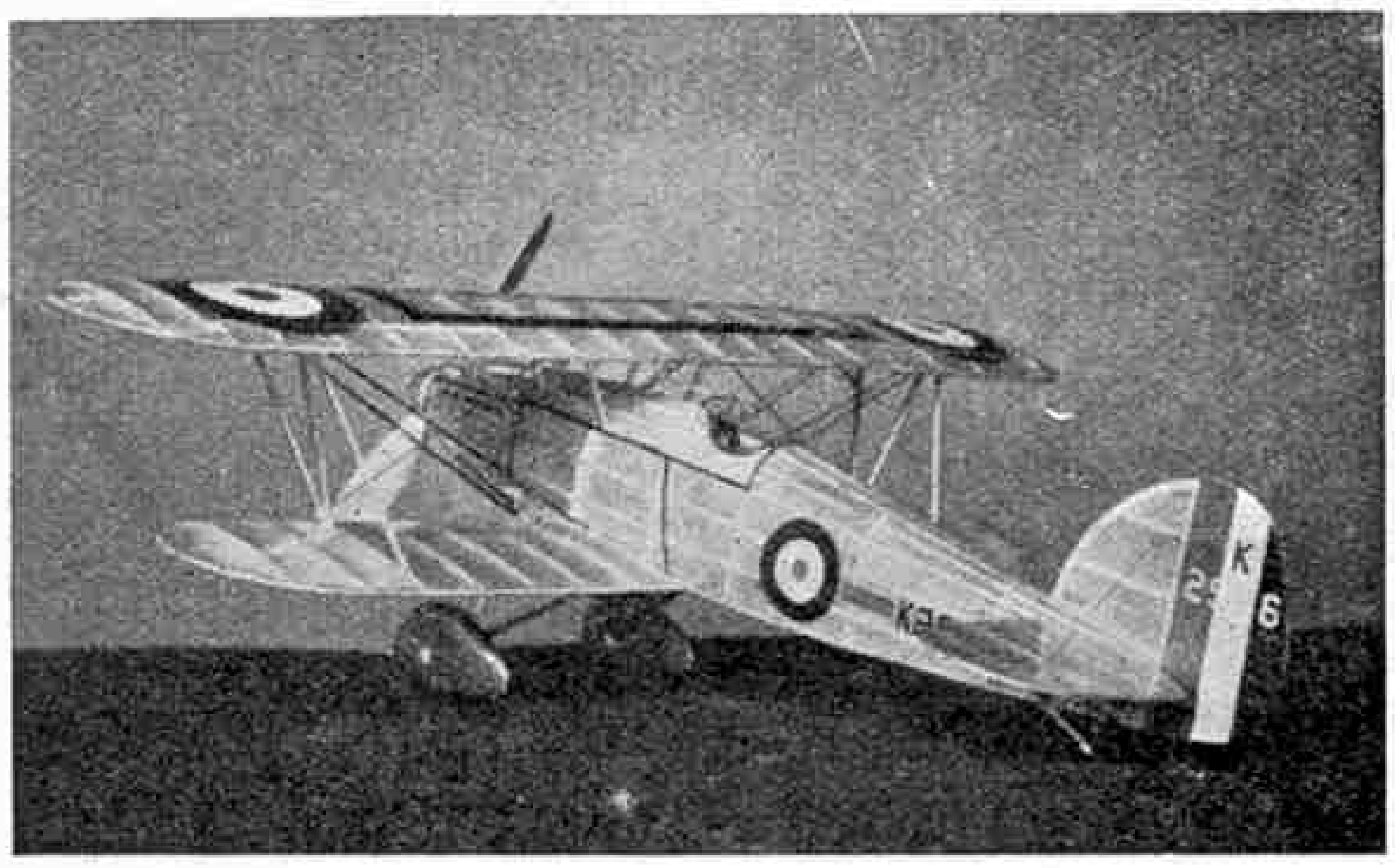
Fascination of building— Fun of flying

You have to try these kits yourself before you can realise the gripping fascination of building them up. How each part almost goes together itself on top of the full-sized plan—the joy of using a cement which is firm in 30 seconds. And when finished you have a model which will really do things and go places!

These flying models are all made on the same principle. You work right on top of the full-sized plan. On this you lay out the various strips of balsa which form the wings, etc. Pins are used to shape the balsa until the very quick drying cement has set. The balsa skeleton-framework is then covered with Japanese tissue, which shrinks taut when damped.

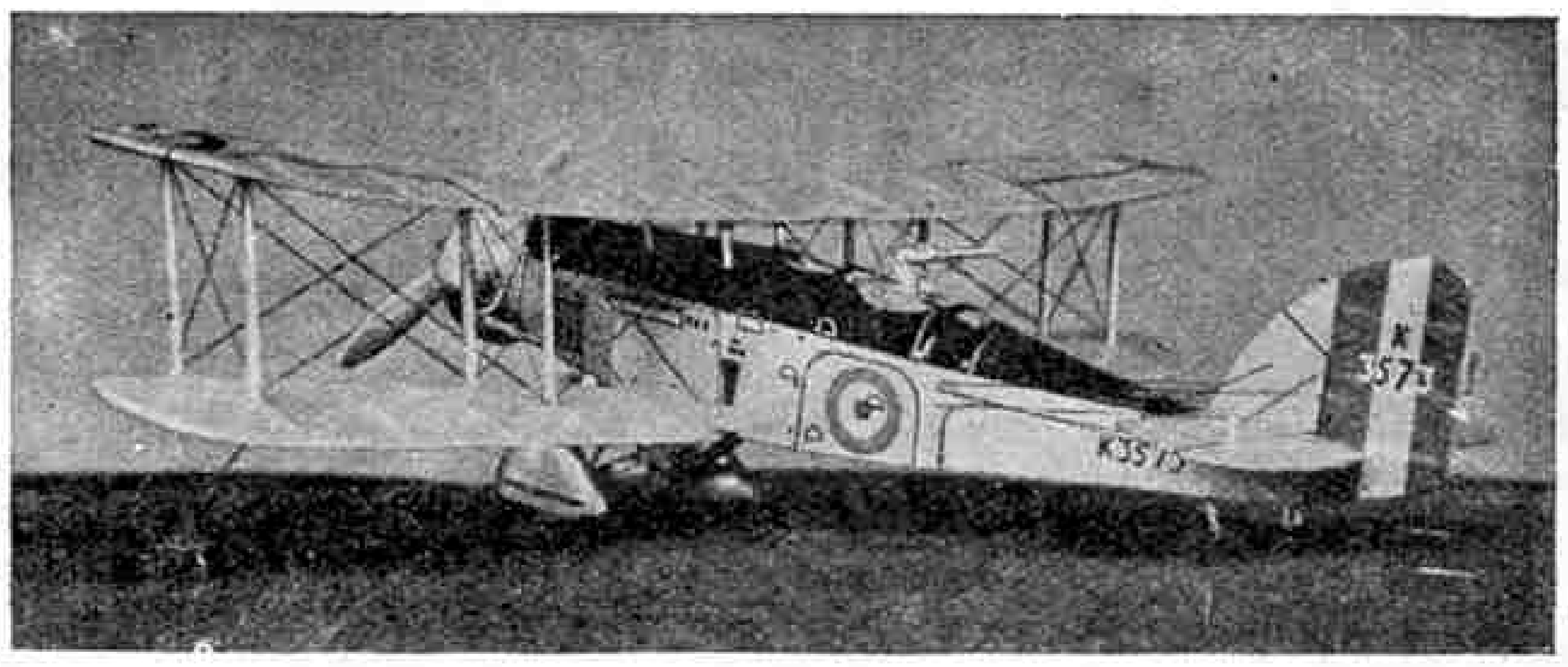
PERCIVAL GULL 3/6

Flying scale model. Wingspan 18 in. Length 12½ in. This is a model of the plane which flew to Africa and back in 17 hours. The plan for building it is clear and straightforward, and being a monoplane is quite easy to make. If you are under 15, however, we do not recommend it as a **first** model. (Try the Puss Moth.) The kit includes all printed and strip balsa needed, shaped balsa flying prop, hardwood wheels, balsa for scale prop, quick drying cement, bottle of blue dope for touch-up, and all else needed. Extra full instructions. Complete kit, carriage paid, for 3/6.



HAWKER FURY 6/6

Wingspan 19¼ in. Length 17 in. Exact ⅝ scale. Just what you want for Christmas! The Fuselage is built on Comet's Auto-line-up method. All control surfaces are movable. It is a good strong flier. The kit contains all balsa needed, double size tube of quick drying cement, carved balsa flying prop, bottle of aluminium dope for touch-up and all else needed. Complete kit, carriage paid, for 6/6.



3/6

WESTLAND WALLACE

Flying scale model. Wingspan 18 in. Length 13 in. The plan is full of real scale details; oil cooling radiator, wing slots, navigation lights, elevator and rudder control wires, all rigging shown, auxiliary tail skid, and many more details. In fact the detail you would expect to find in a really expensive kit. Full instructions and material for movable machine gun on Scarfe ring for rear cockpit. Cowl is built up from balsa, you do not have to carve it out. Comet's famous Auto-line-up method of fuselage construction. A special feature is that the kit includes SILVER TISSUE. The kit is very complete and includes all printed and strip balsa needed, shaped balsa flying prop, hardwood scale wheels, quick drying cement, printed insignia, etc. Boys over 15 should find it fairly easy. Complete kit, carriage paid, for 3/6.

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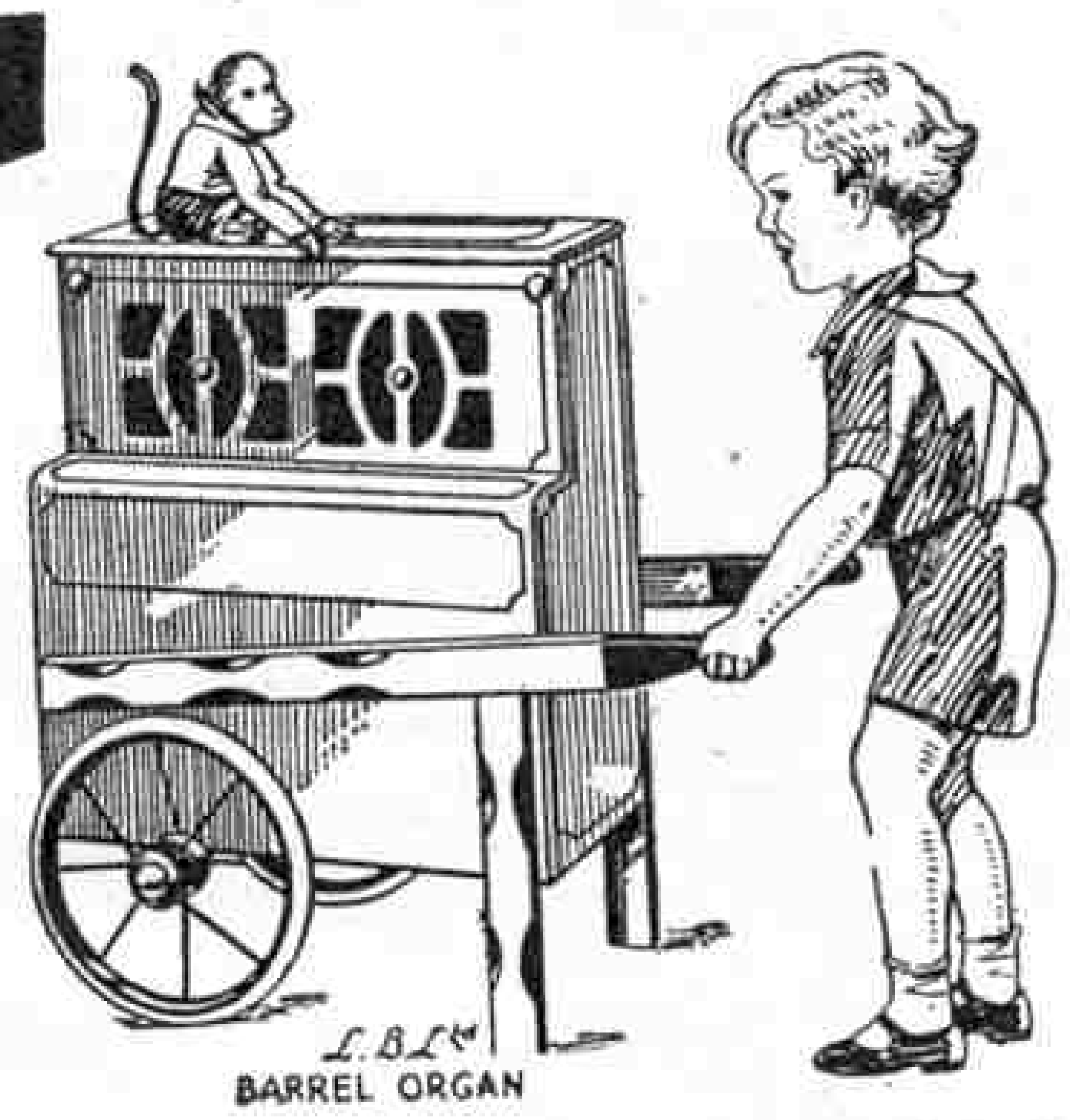

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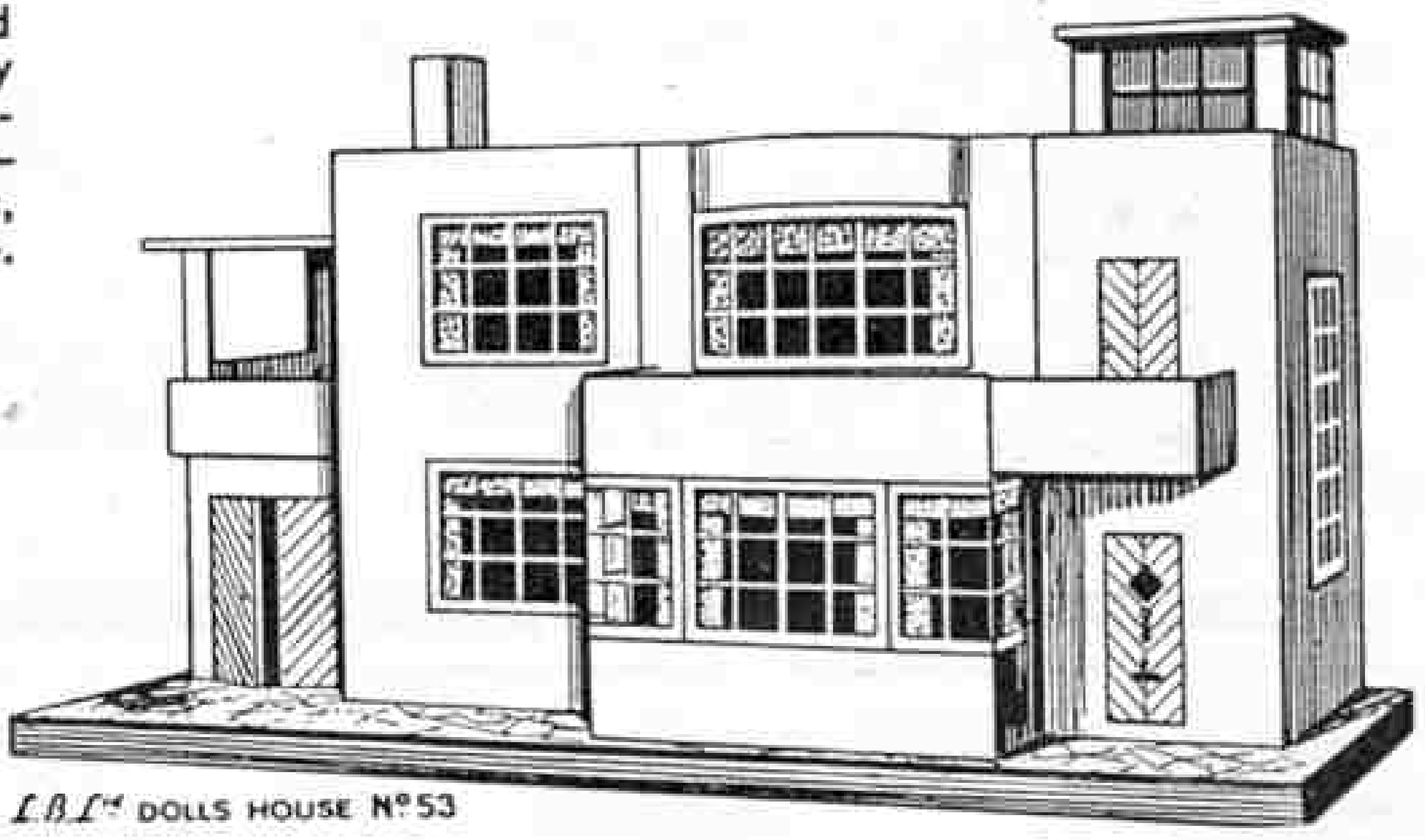
Smaller models **29/6** and **39/6.**



DOLLS' HOUSE No. 53. Four large rooms, fitted with electric wall lights. Metal framed windows. Kitchen fitted with dummy gas stove, sink and dresser. Built-in garage. Movable suntrap. Finished in cream and green, with imitation crazy paving. Length 42 ins. Price **49/6**

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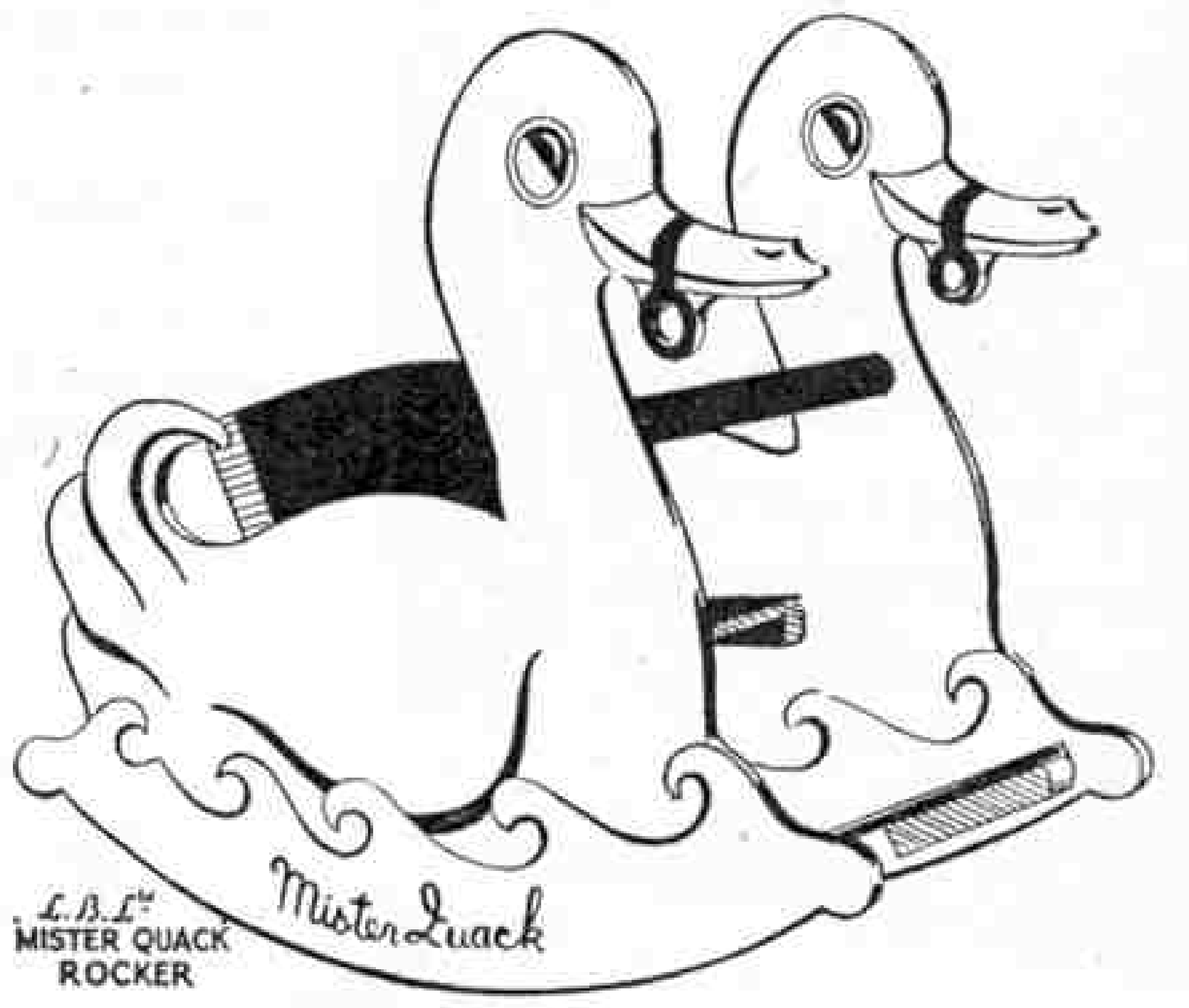
Other models **29/6**, **49/6**, **55/–** and **59/6**.



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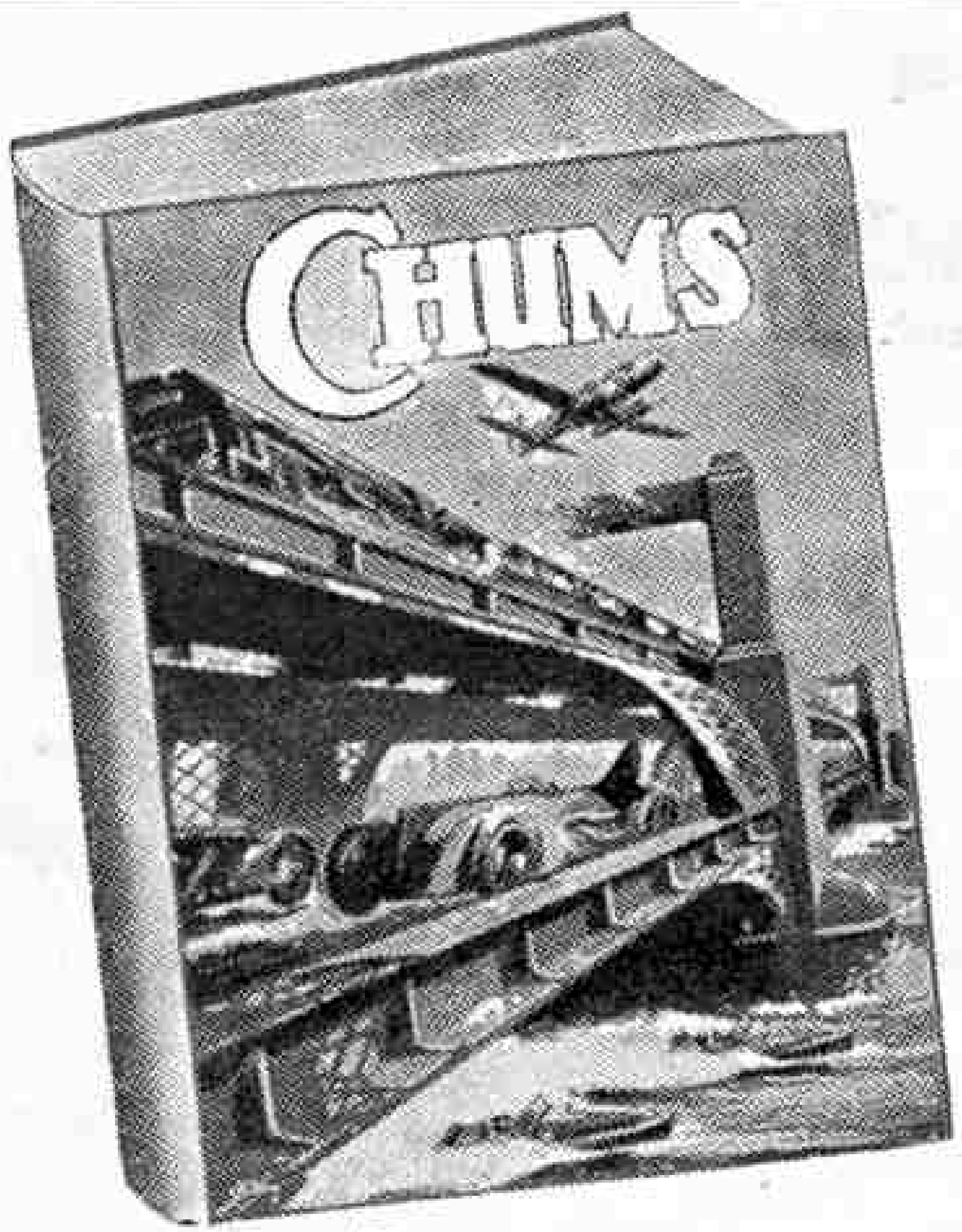

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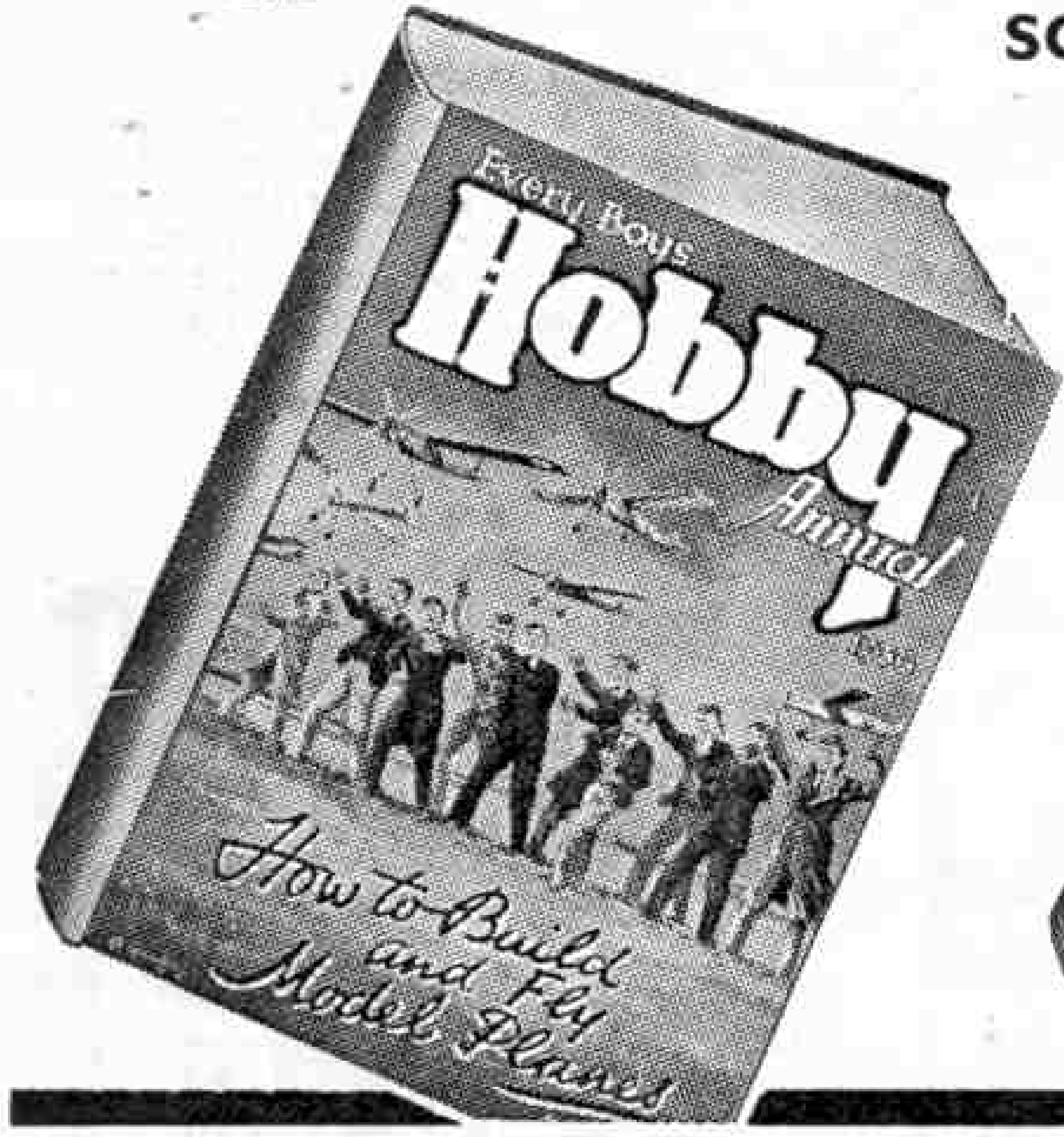
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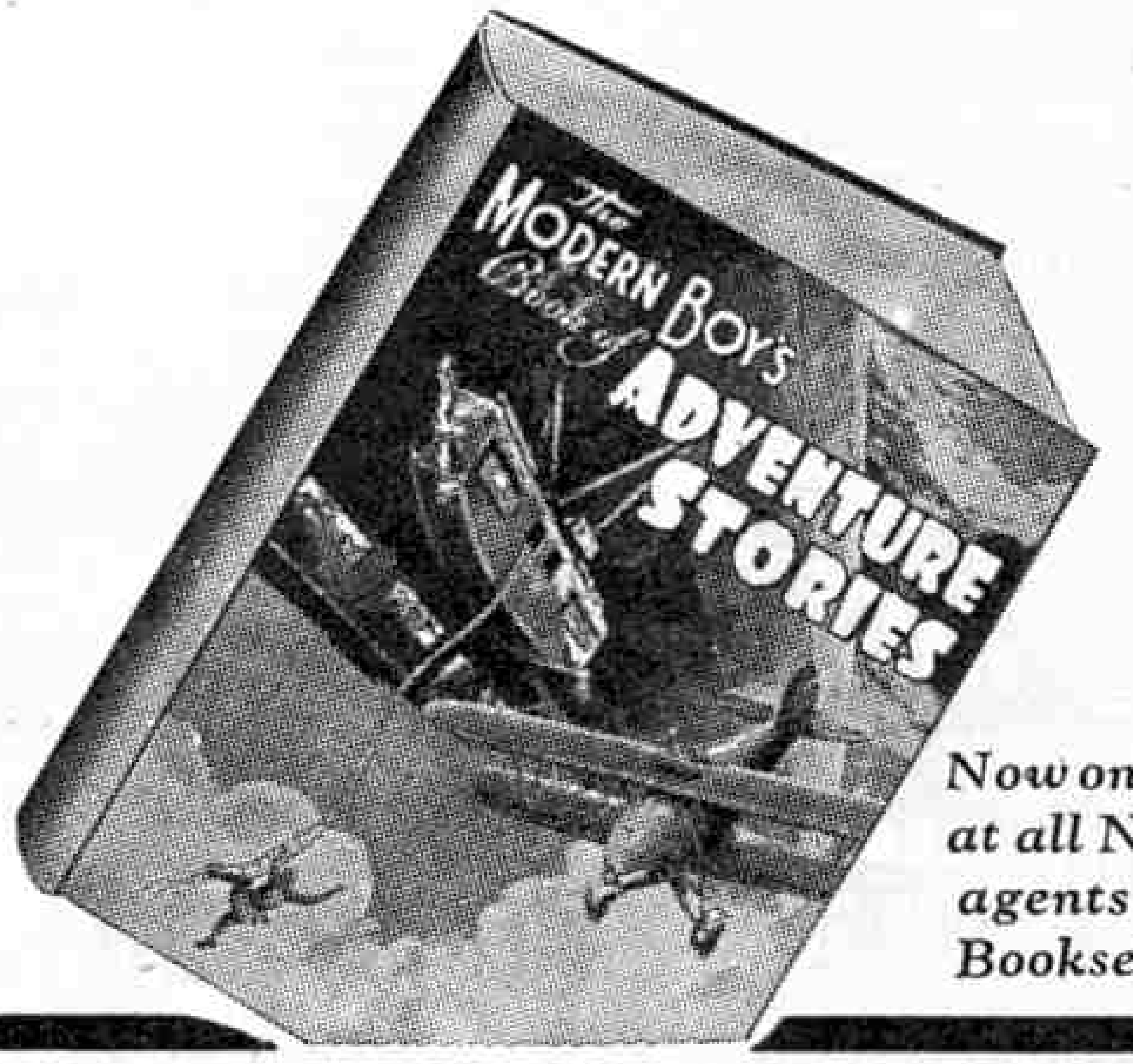
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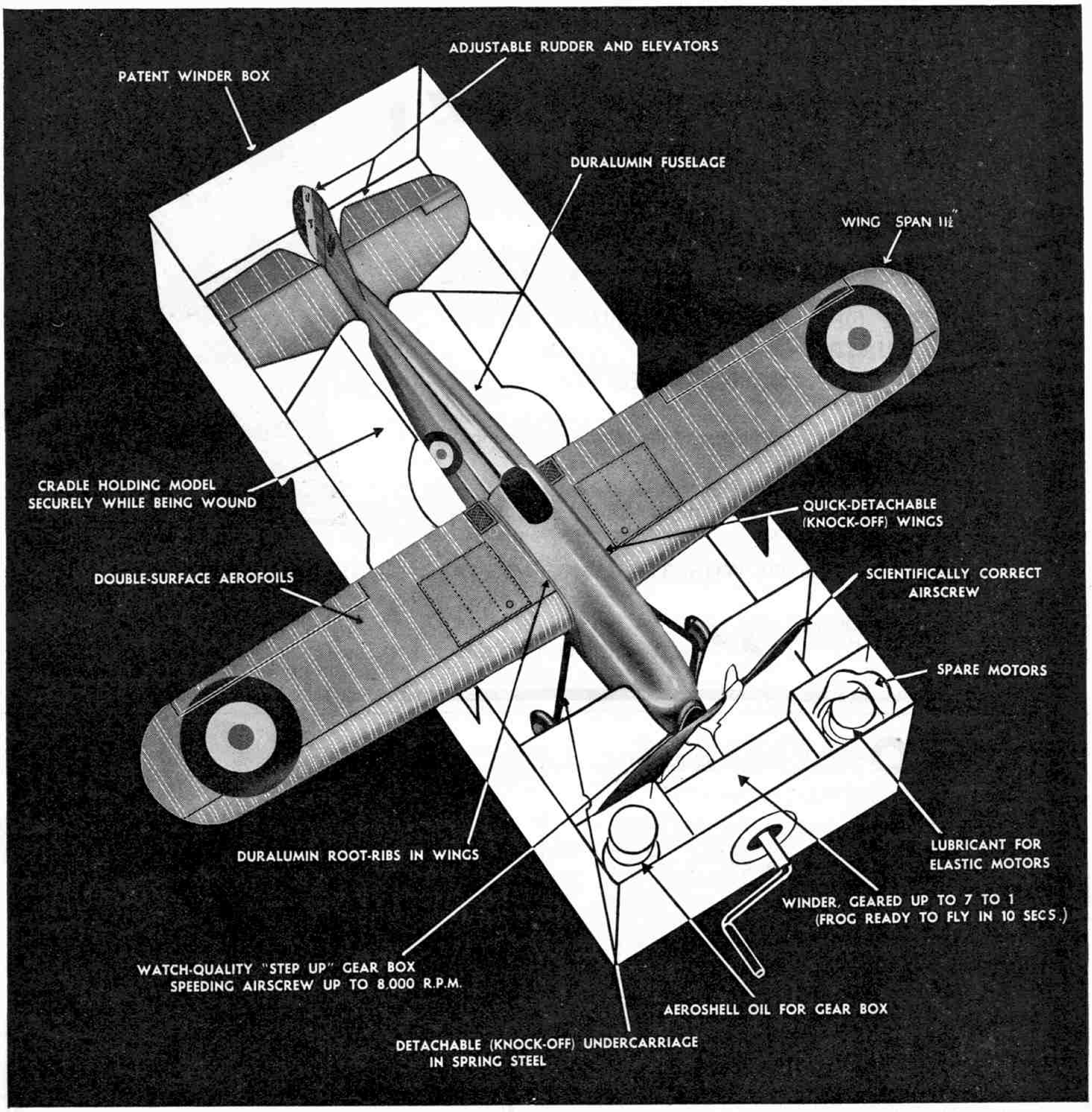
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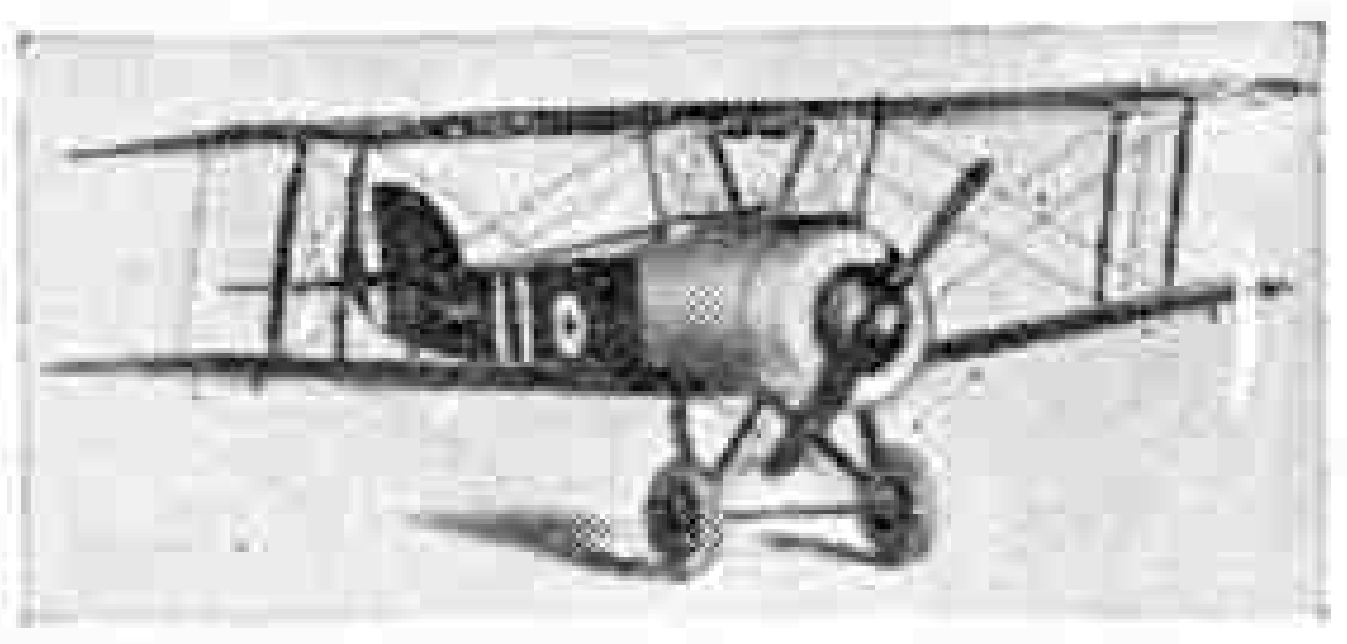

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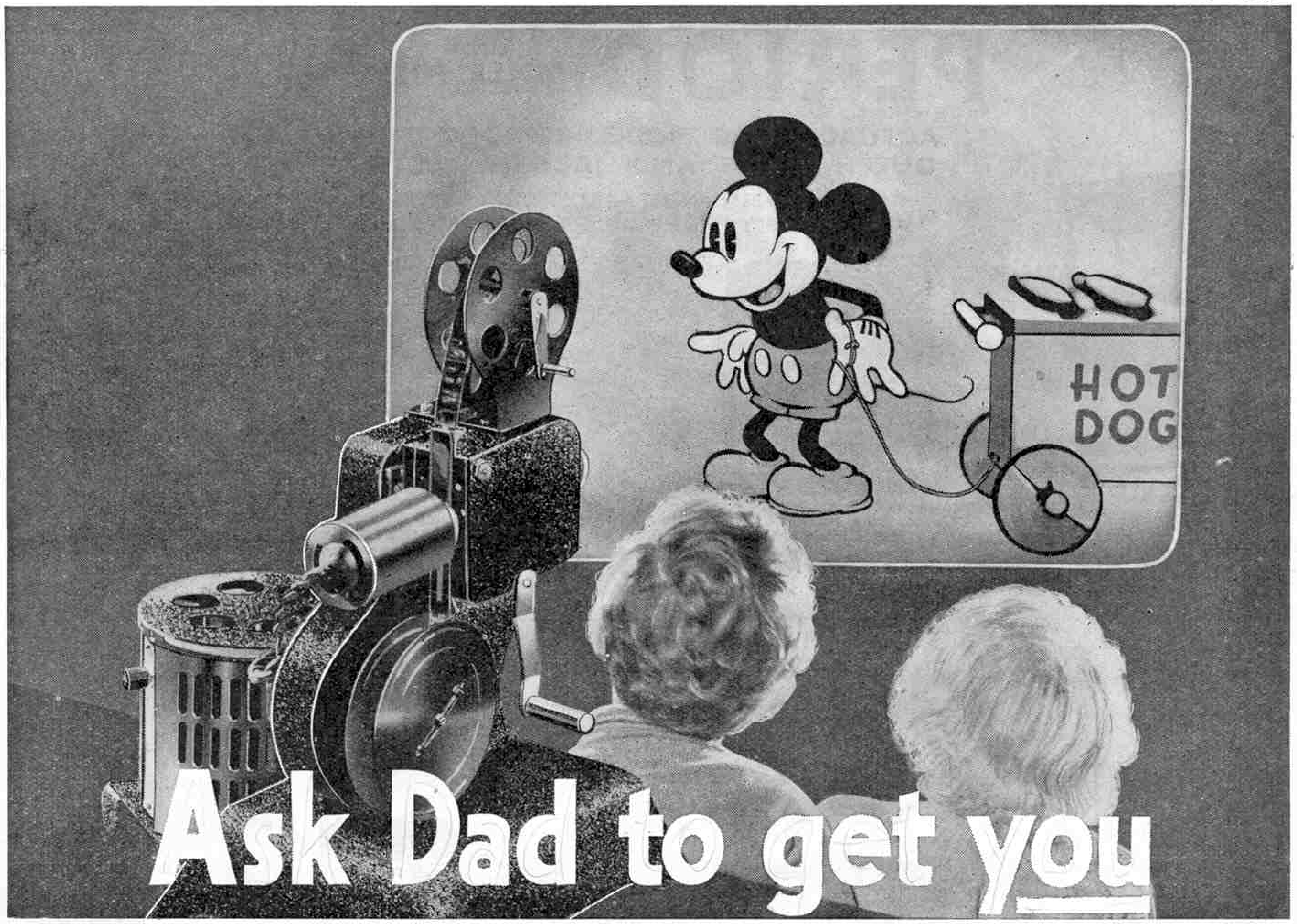

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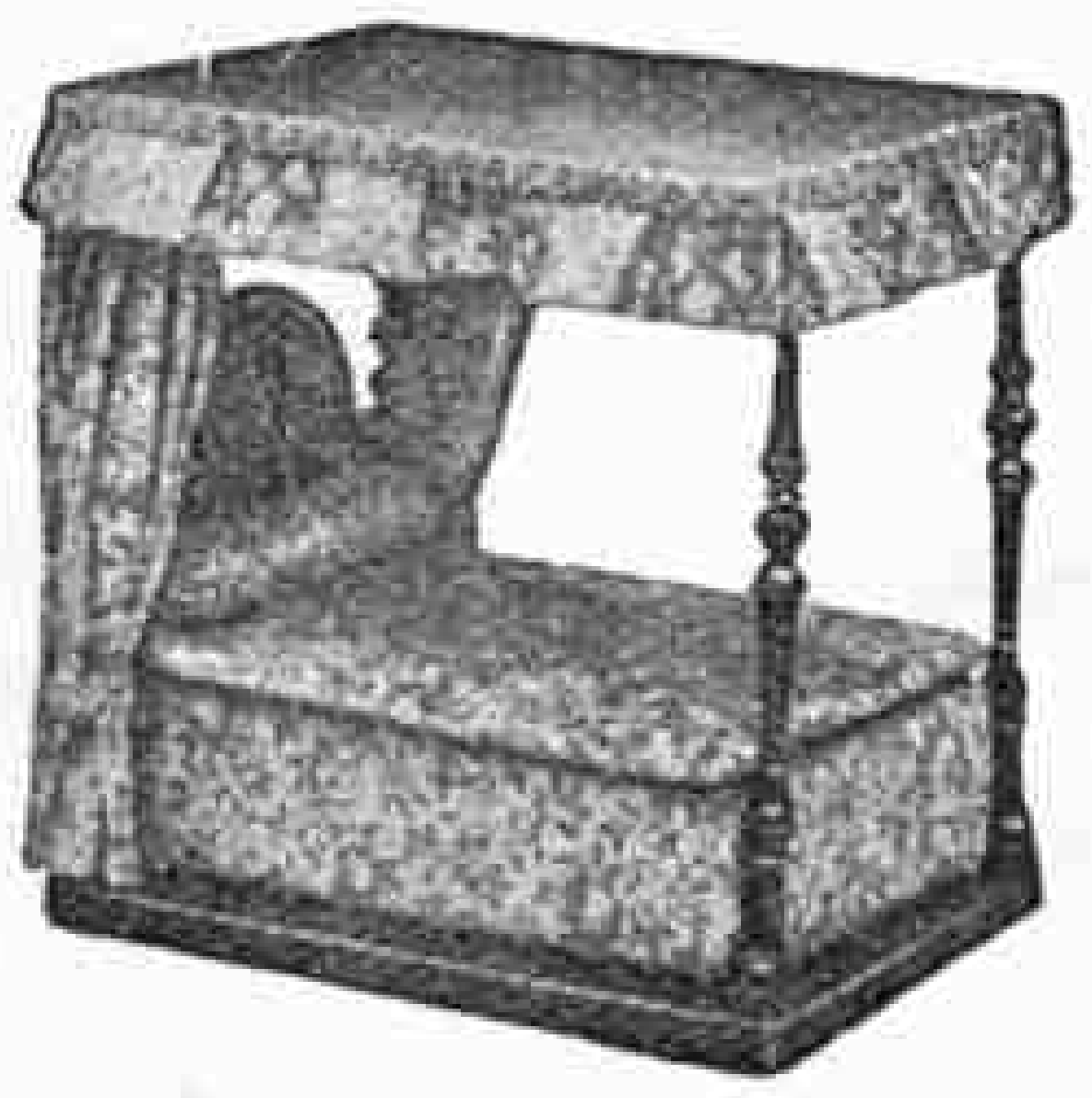

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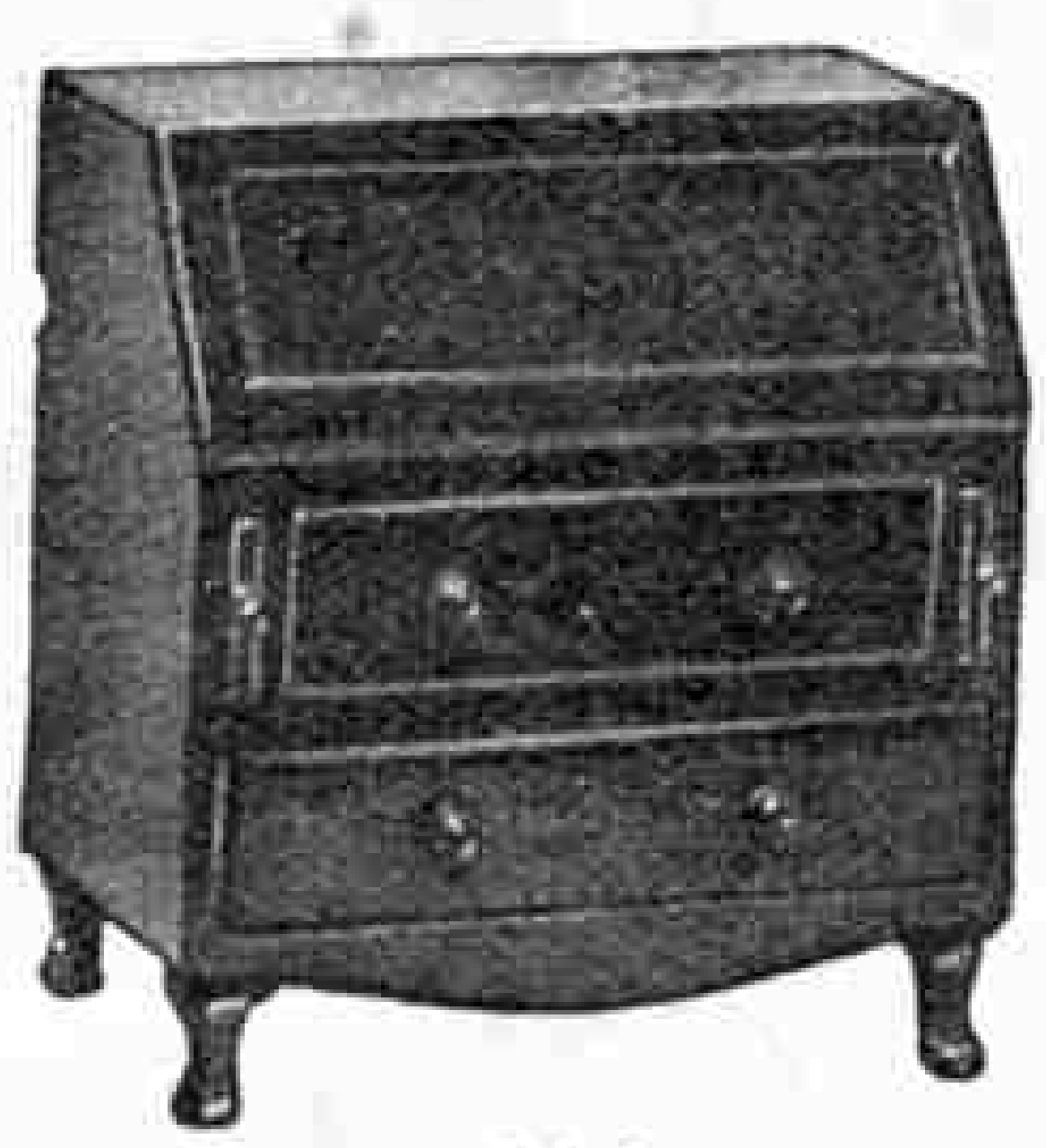
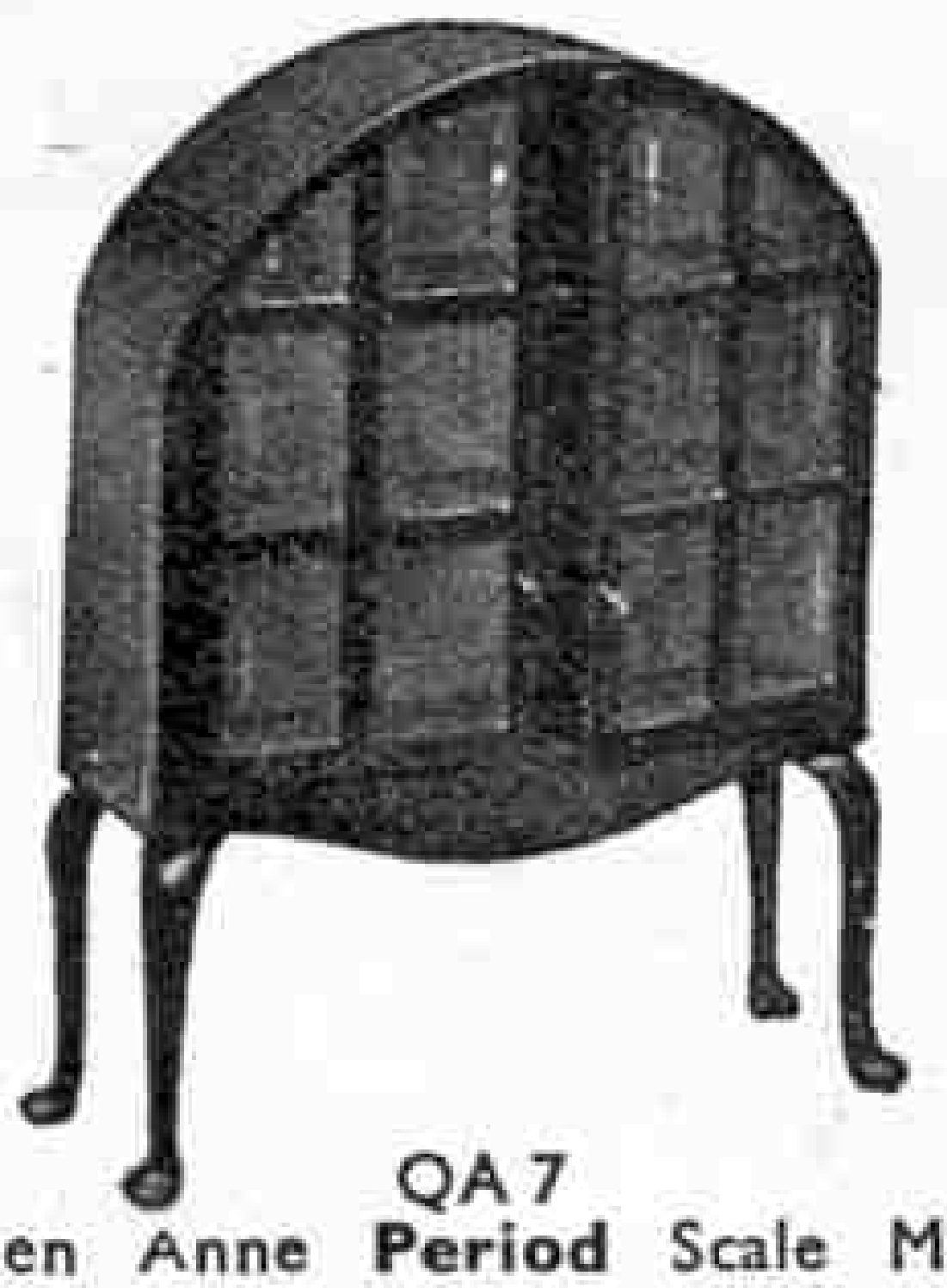
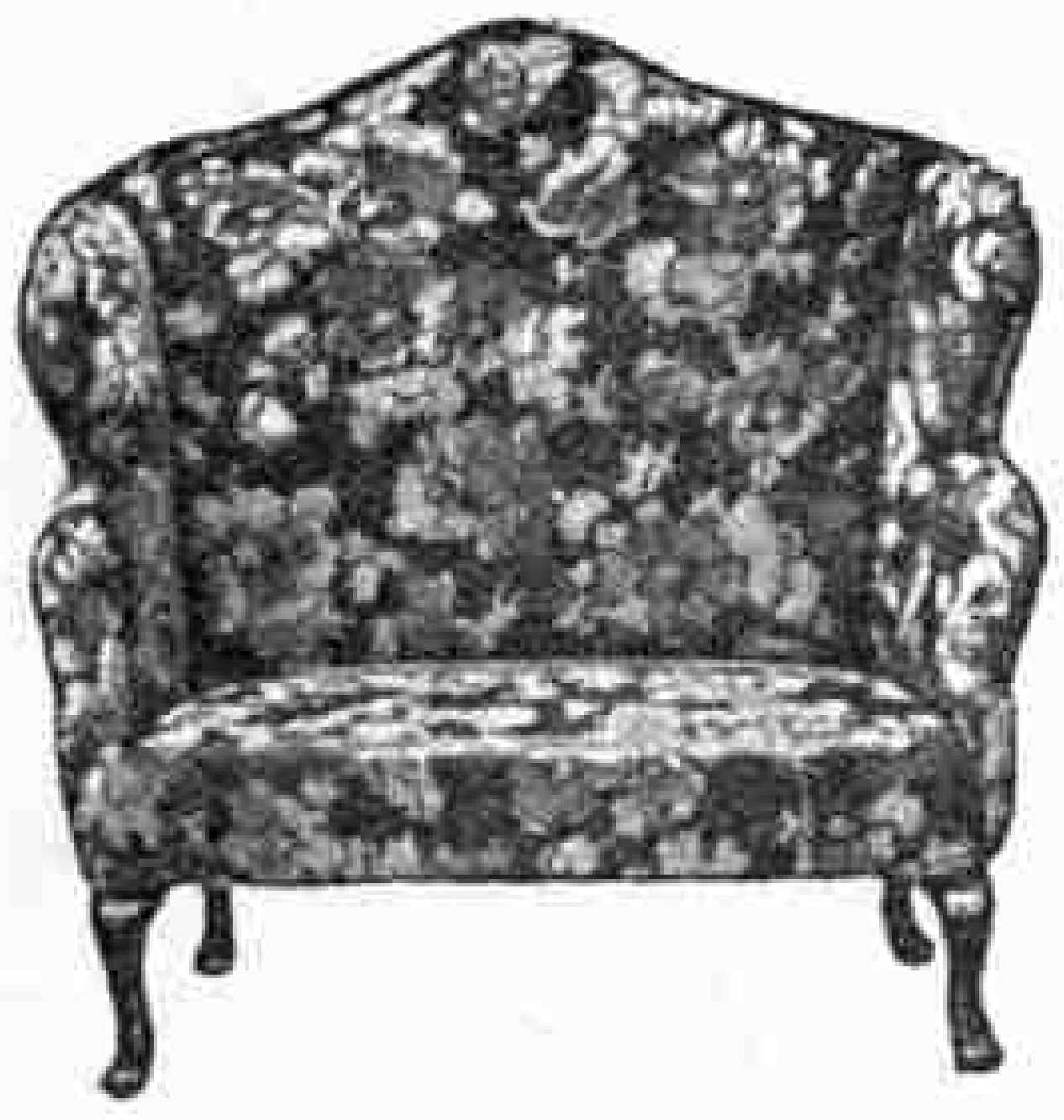


QA 2
Queen Anne **Period** Scale Model
WRITING BUREAU
Two drawers, fall flap, inside fitted with pigeon holes. Short Cabriole legs. 6/6

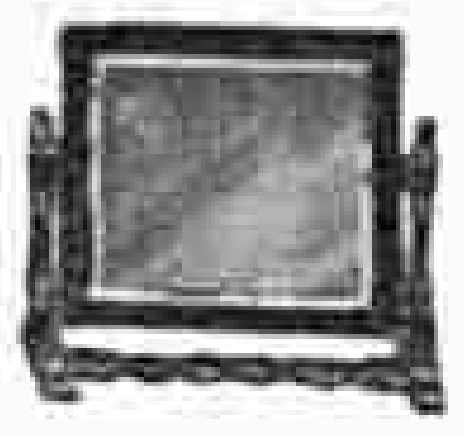


QA 7
Queen Anne **Period** Scale Model
CHINA CABINET
Interior shelves and transparent opening doors. Cabriole legs. Walnut finish with whorl grain markings. 5/–

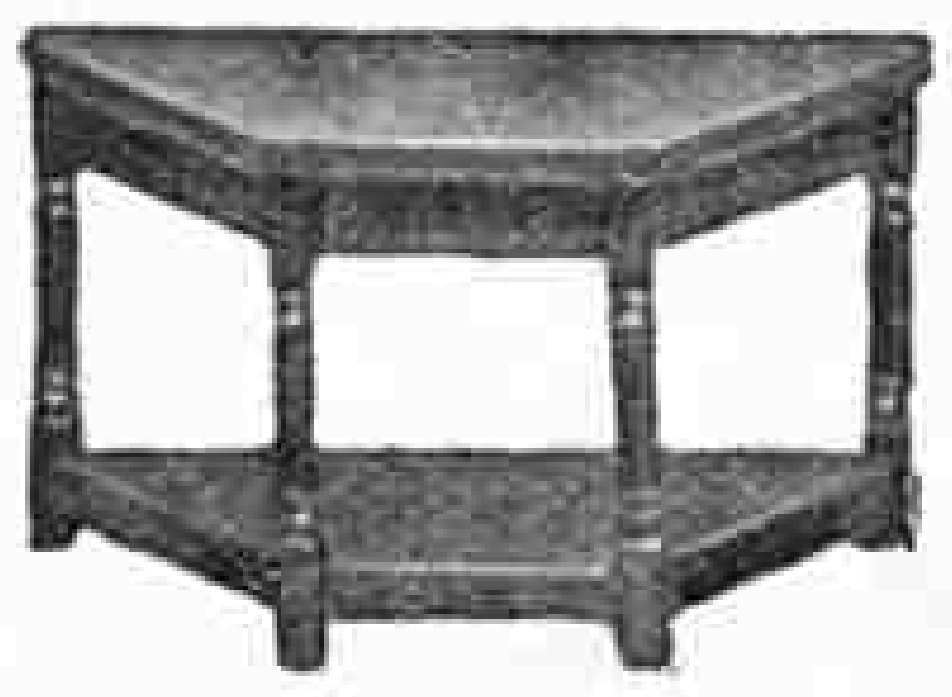


QA 9
Queen Anne **Period** Scale Model
SETTEE
Shaped sides and back. Upholstered to match Easy Chair. Short Cabriole legs. 2/6

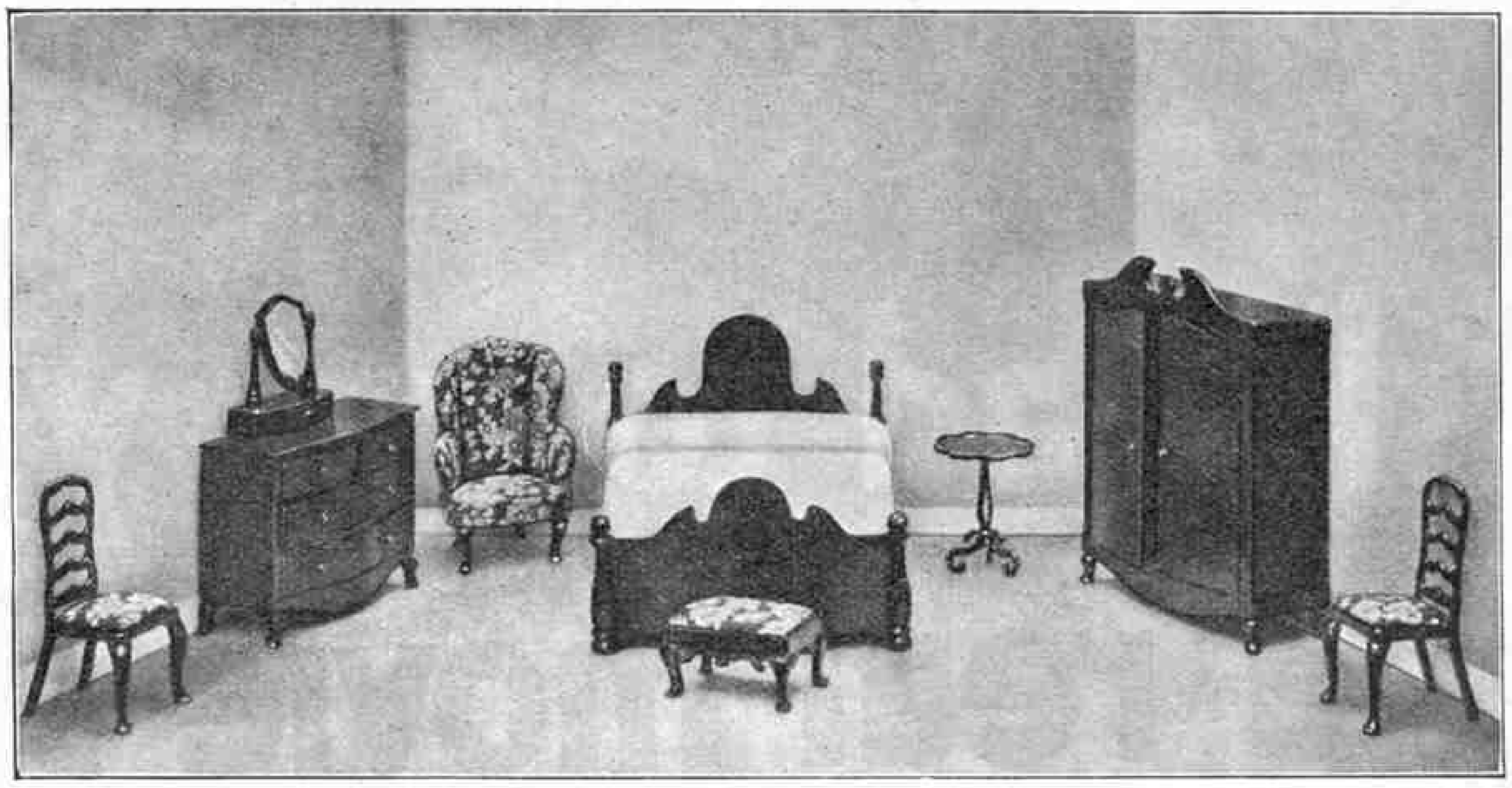
All Queen Anne models have beautiful walnut finish



J 57
Jacobean **Period** Scale Model
DRESSING MIRROR No. 2
Adjustable position, turned arms, shaped base. 1/9



J 58
Jacobean **Period** Scale Model
SIDE TABLE
Half hexagon top, four turned legs with square feet. 1/9

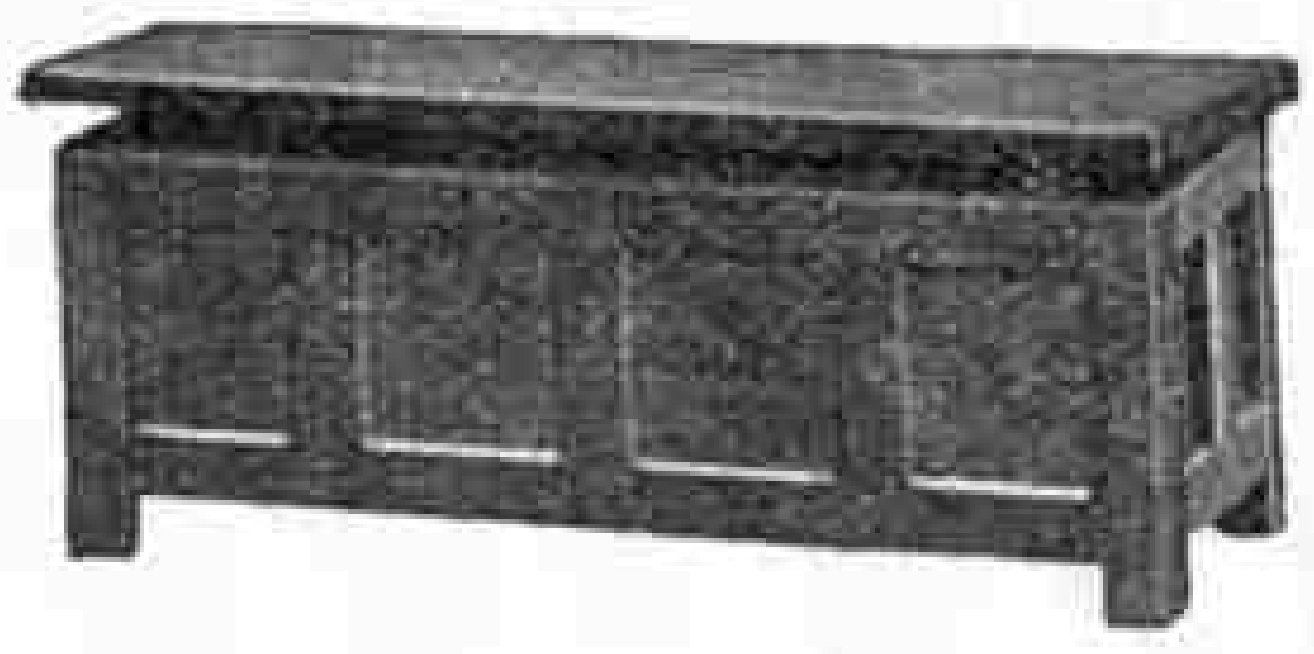


Queen Anne **Period** Scale Model **BEDROOM SET 22/6**
Containing Bedstead, QA 17, 3/6; Wardrobe, QA 16, 4/–; Chest of Drawers, QA 19, 6/6; Dressing Mirror No. 1, QA 18, 1/9; two Chairs No. 2, QA 4, 1/–; Easy Chair, QA 8, 1/9; Footstool, QA 15, 1/–; Occasional Table, QA 12, 9d. The complete set is packed in a handsome box. Or each piece can be obtained separately. **Dining Room Sets, 19/6: Drawing Room Sets, 25/–.**

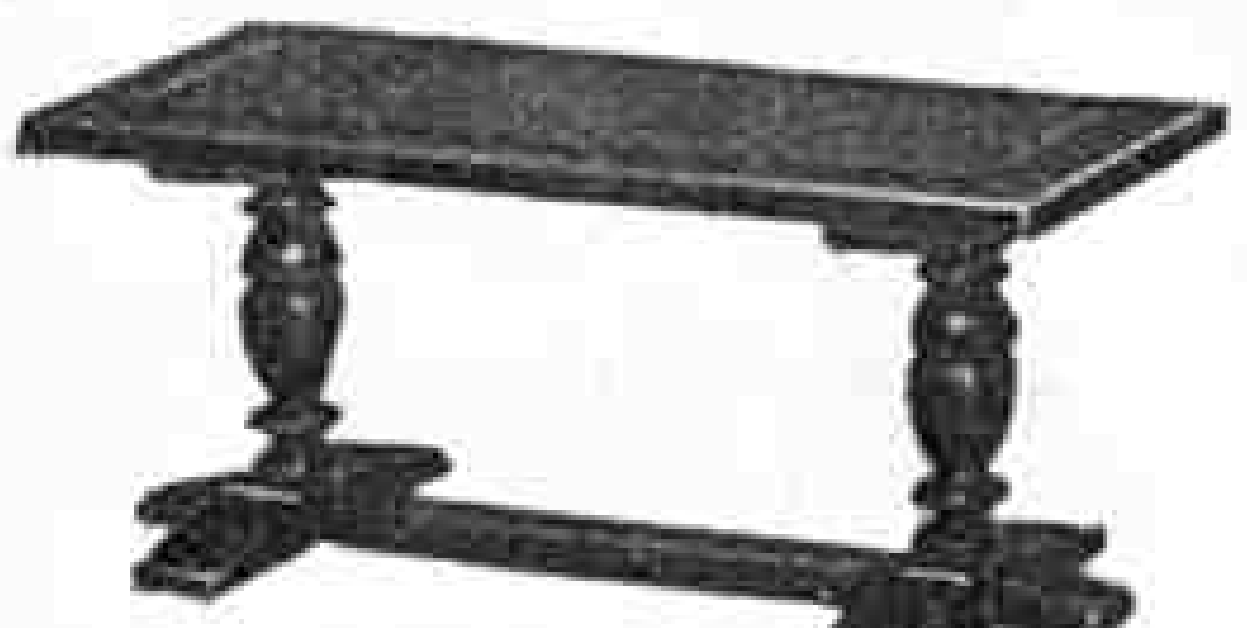
QA 13
Queen Anne **Period** Scale Model
HANGING MIRROR
For hanging over console table. 1/–

QA 11
Queen Anne **Period** Scale Model
CONSOLE TABLE
Well polished top and beautifully turned Cabriole legs. 1/–

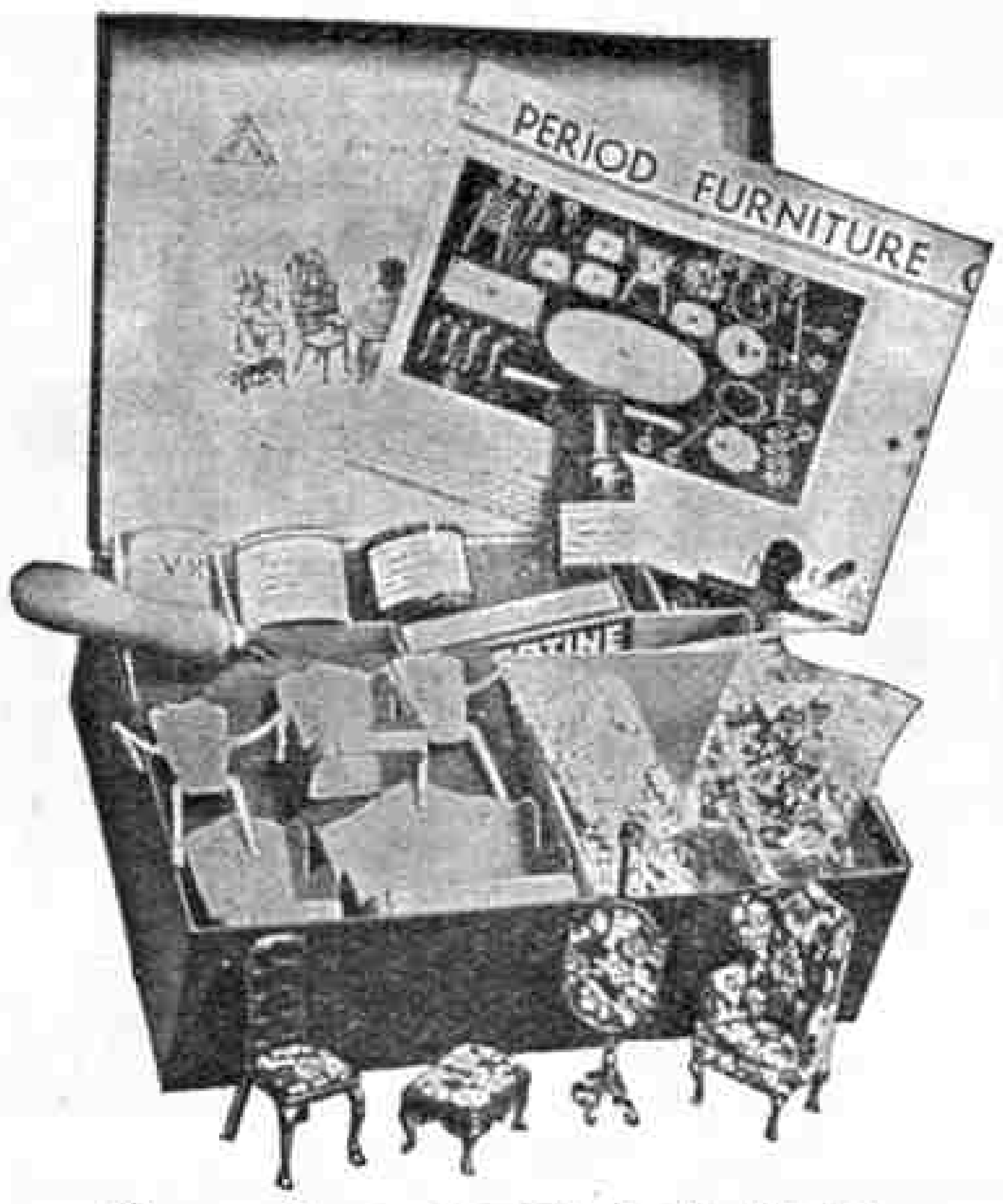
J 55
Jacobean **Period** Scale Model
ARMCHAIR
Velvet seat and back. Bobbin turned legs. 1/3



J 54
Jacobean **Period** Scale Model
OAK CHEST
Hinged lid, plain panels divided by stiles. 1/9



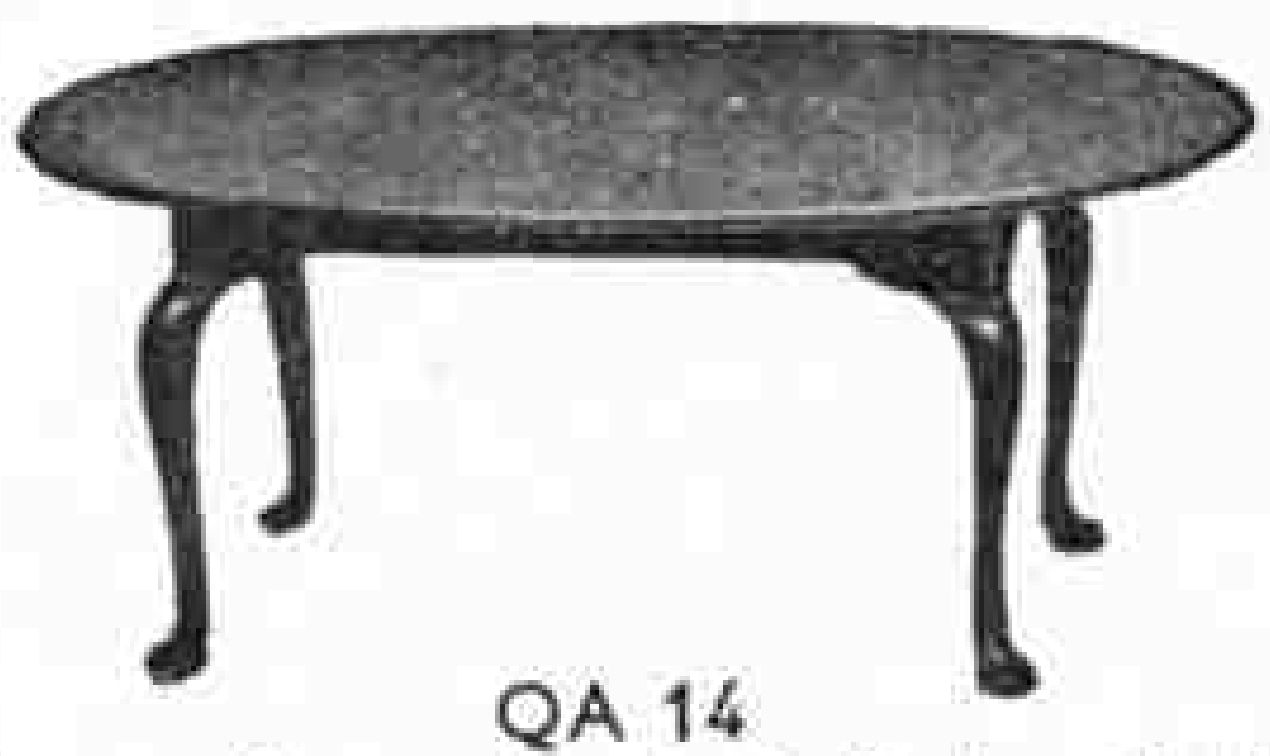
J 59
Jacobean **Period** Scale Model
REFECTORY TABLE
Carved top, solid turned legs. A particularly well made piece. 1/9



Queen Anne **Period** Scale Model
CONSTRUCTIONAL SET No. 1
Each piece is delicately cut out and shaped. The set is complete with stain, lacquer, upholstery and full equipment, also step by step instruction leaflet for making this wonderful scale model **Period** Furniture. 12/6

QA 10
Queen Anne **Period** Scale Model
SIDE TABLE
Imitation marble top. Cabriole legs. 1/9

QA 3
Queen Anne **Period** Scale Model
WRITING ARMCHAIR
Gracefully shaped solid slat. Seat covered in floral material. Turned Cabriole legs. 1/3



QA 14
Queen Anne **Period** Scale Model
DINING ROOM TABLE
Highly polished oval top, Cabriole legs. 1/9

You can also obtain JACOBEAN BEDROOM SETS for 16/6 and DINING ROOM SETS 12/6
All sets are packed in a handsome box.

Regd. Trade Mark

Ask your dealer to show you the complete range of QUEEN ANNE and JACOBEAN Scale Model Furniture.

Regd. Trade Mark

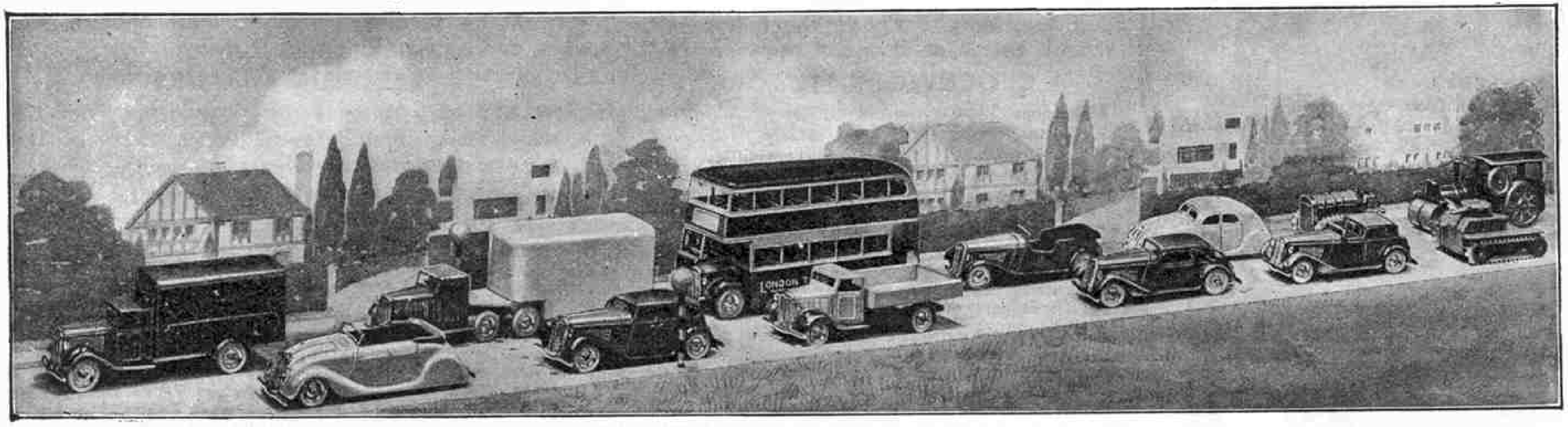
MADE BY **LINES BROS. LTD., Tri-ang Works, Morden Road, London, S.W.19**

MINIC

Regd. Trade Mark

ALL TO SCALE CLOCKWORK TOYS

STRONG CONSTRUCTION
POWERFUL LONG RUNNING MECHANISM
FRONT WHEEL DRIVE



Actual photograph of **MINIC** all to scale Clockwork Toys on model roadway

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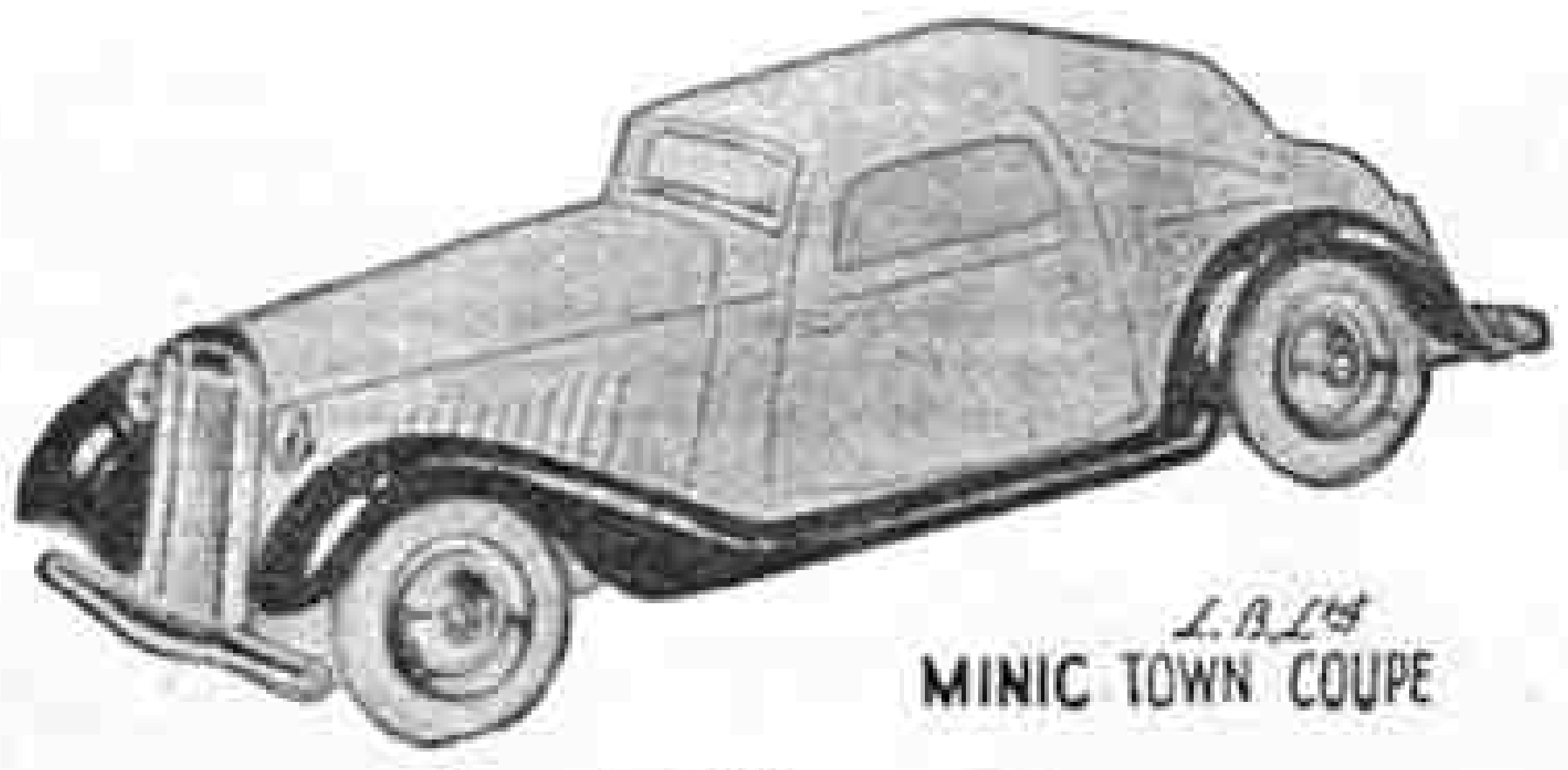
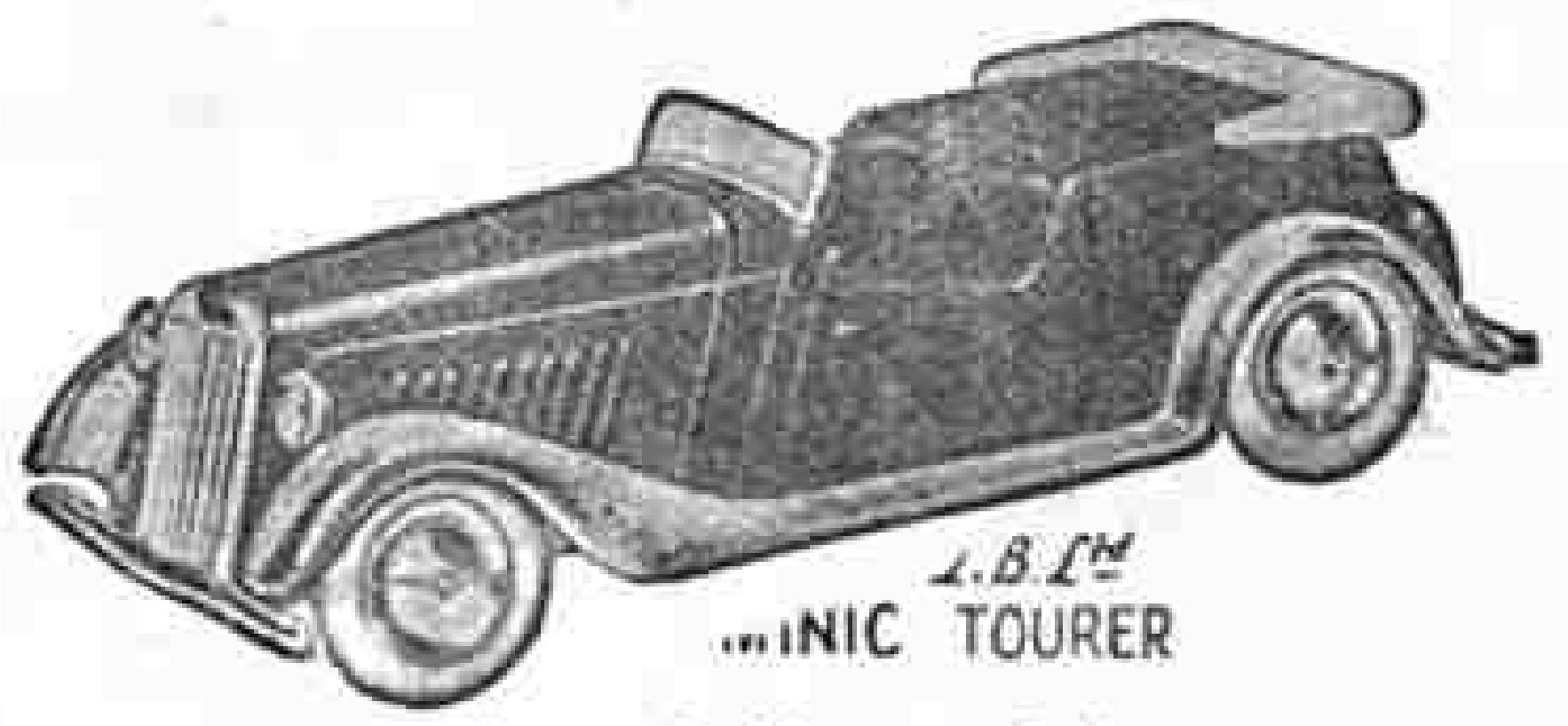
MINIC LIMOUSINE
Length 4⅝ ins. 1/-



L.B.Ltd
MINIC TOWN COUPE
Length 4⅝ ins. 1/-



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Length 4⅝ ins. 1/-

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Length 7¼ ins. 5/-

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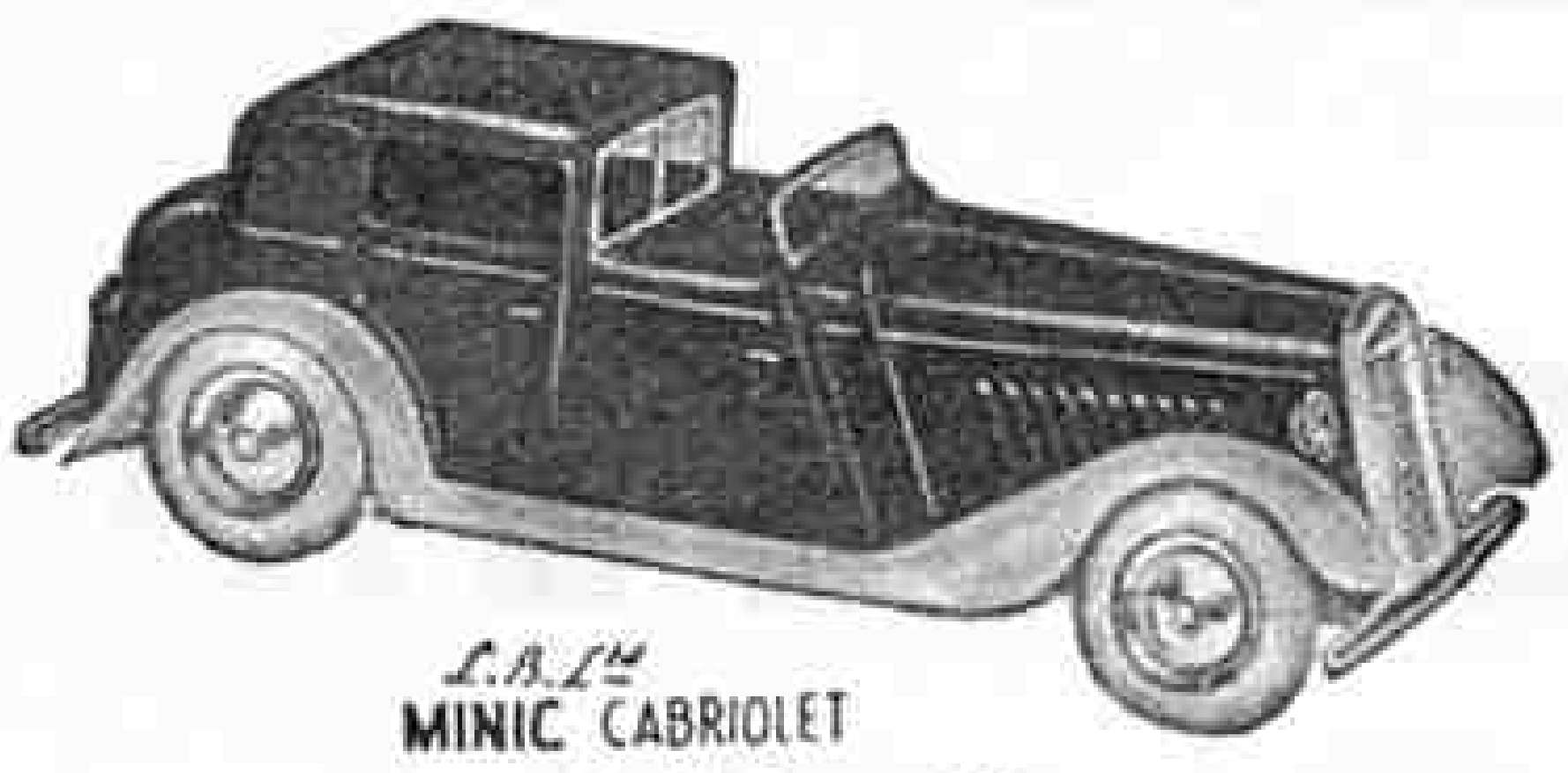
Length 5 ins. 1/-



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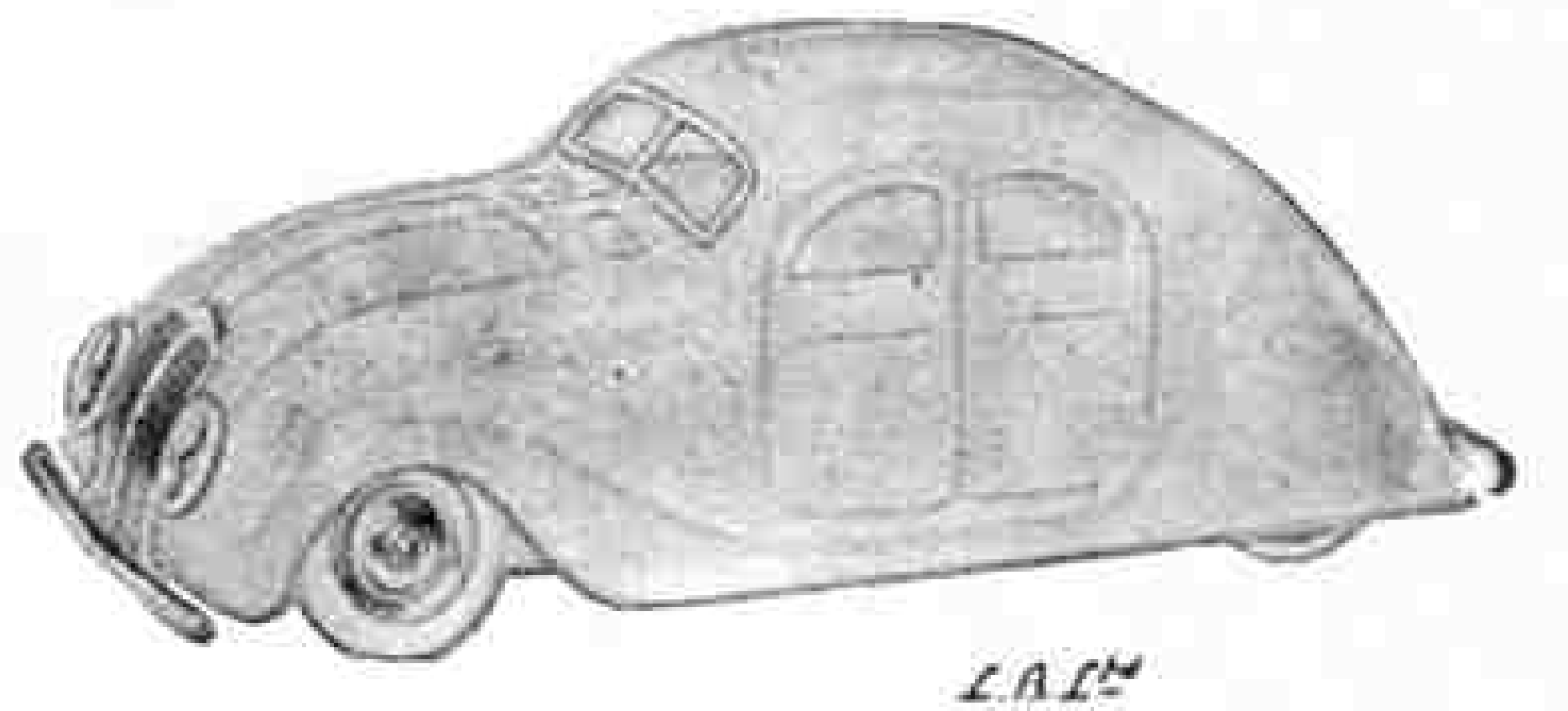
Length 4⅝ ins. 1/-



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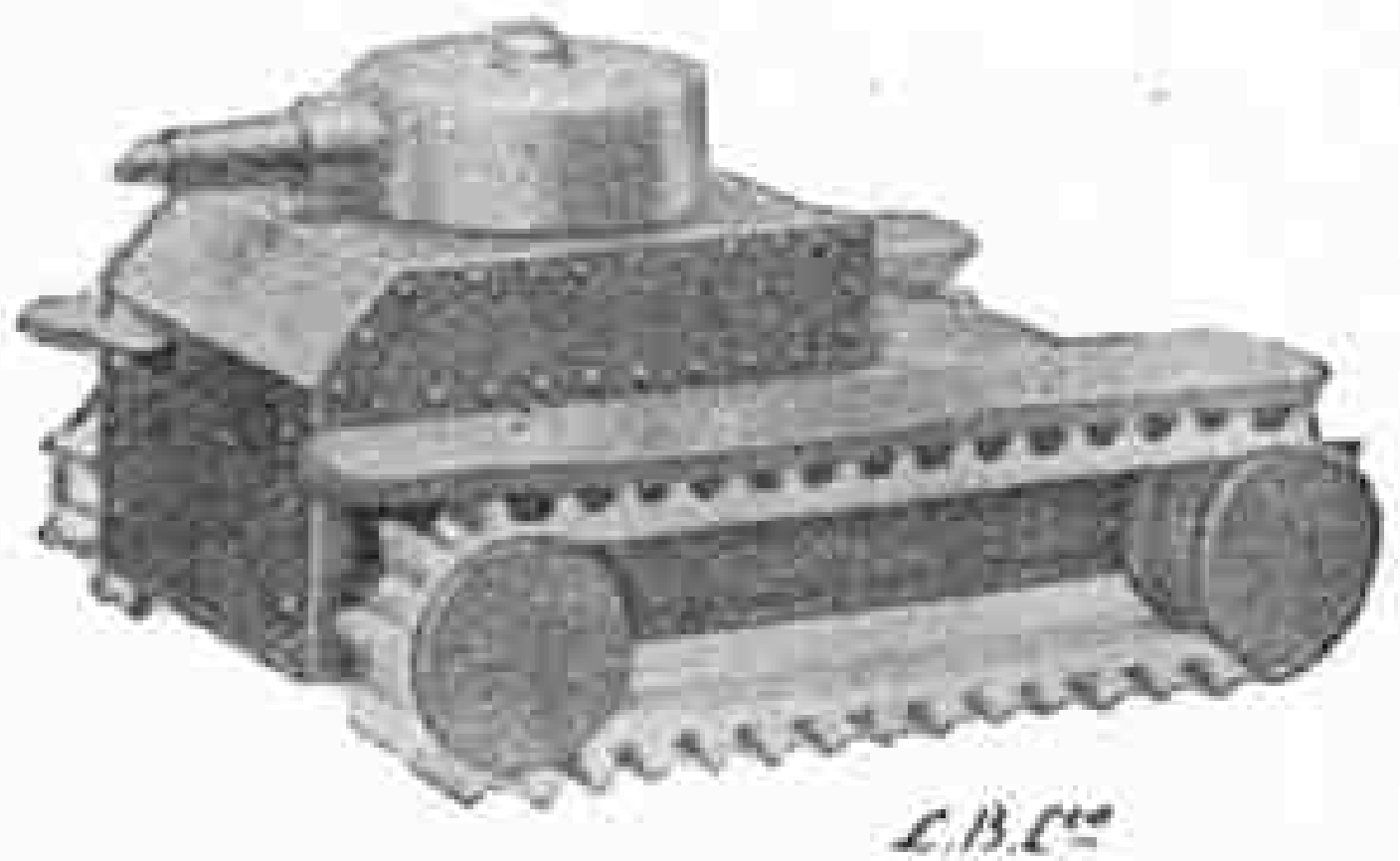
Length 5 ins. 1/-



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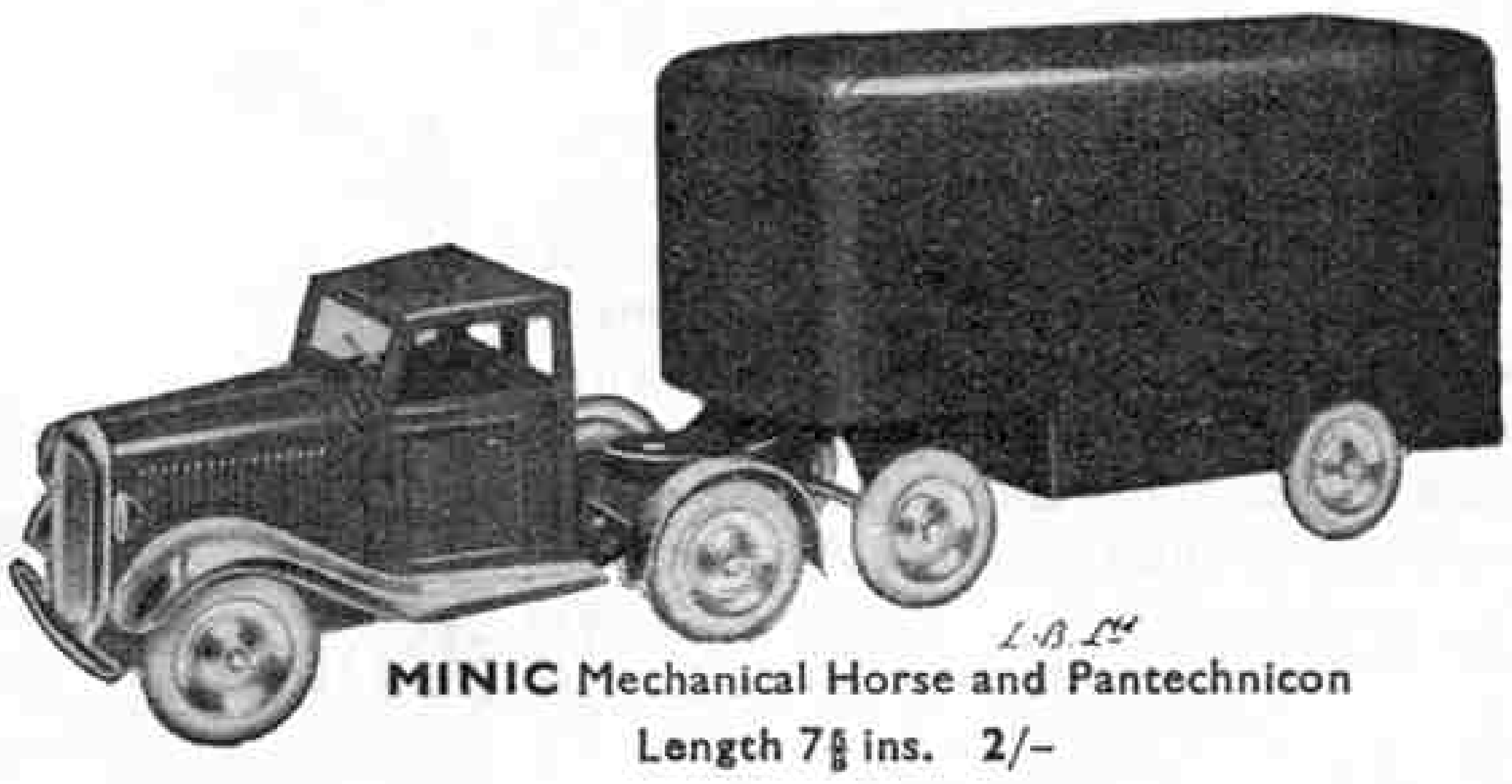
MINIC TANK
Length 3¼ ins. 1/6



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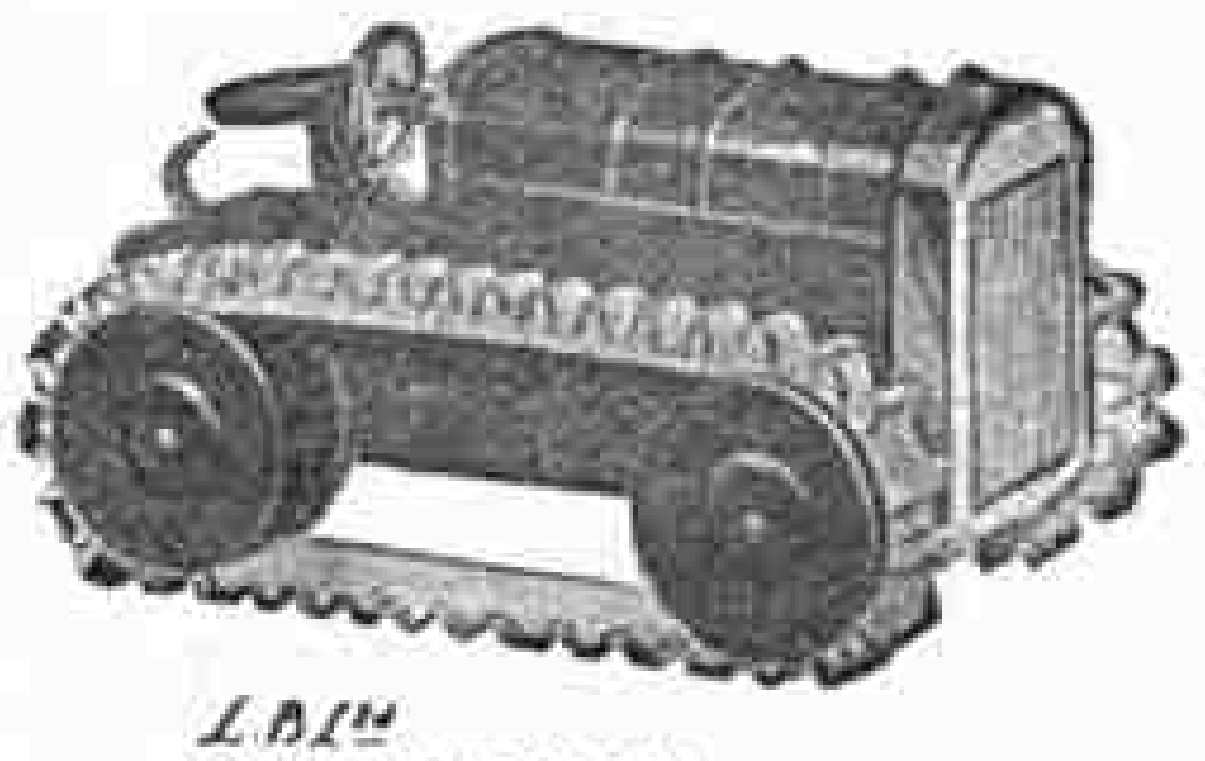

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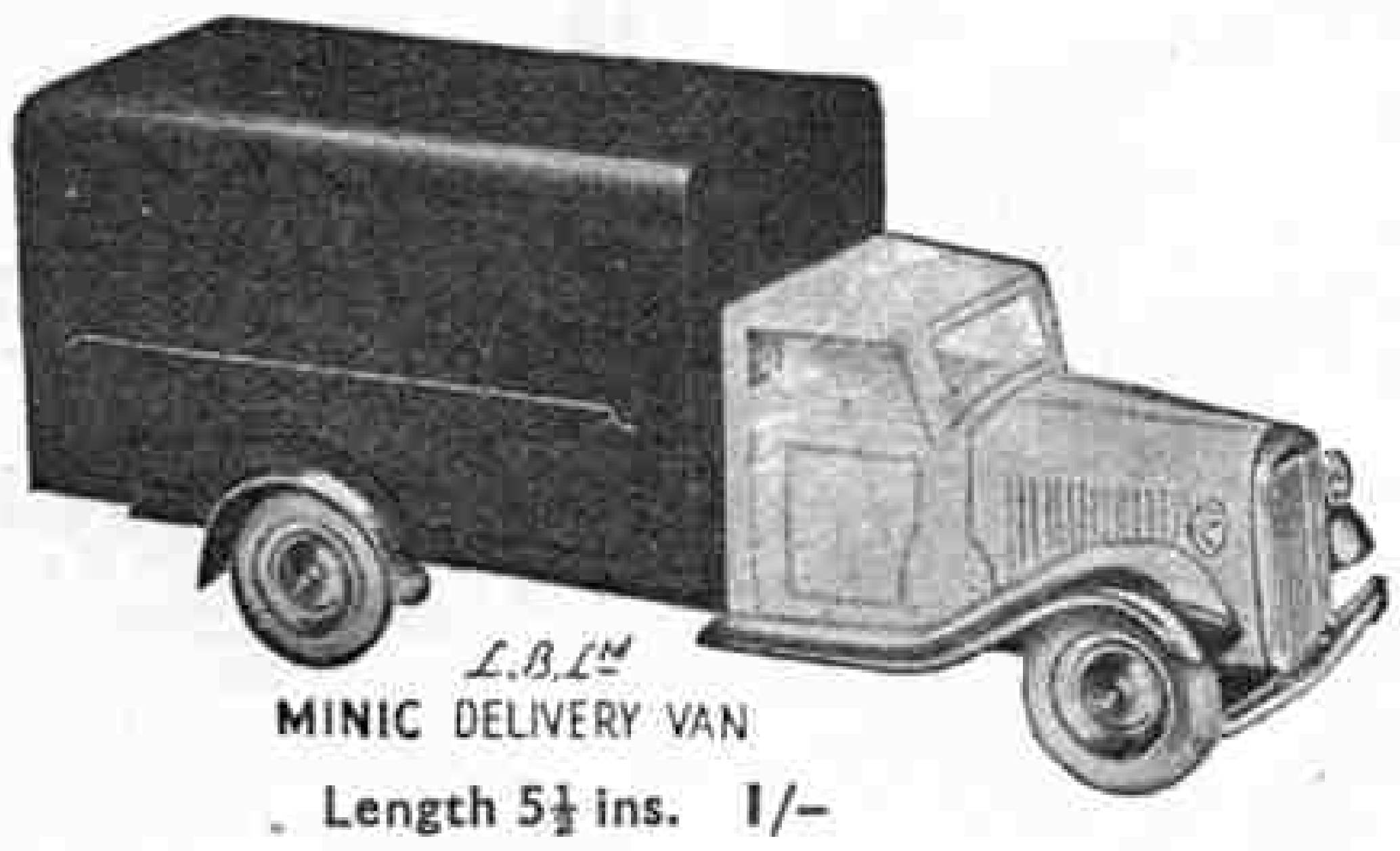

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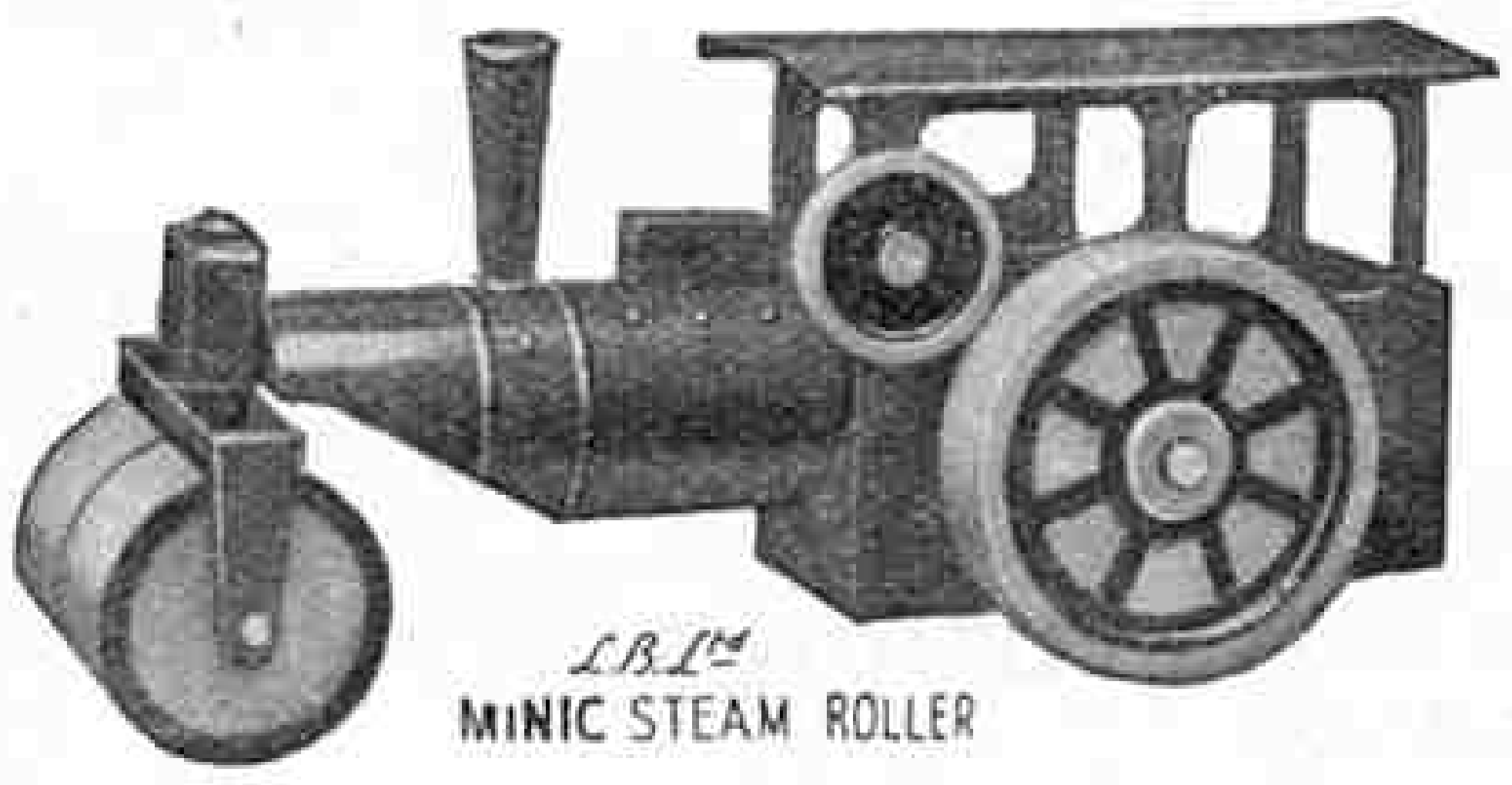
MINIC DELIVERY VAN
Length 5½ ins. 1/-



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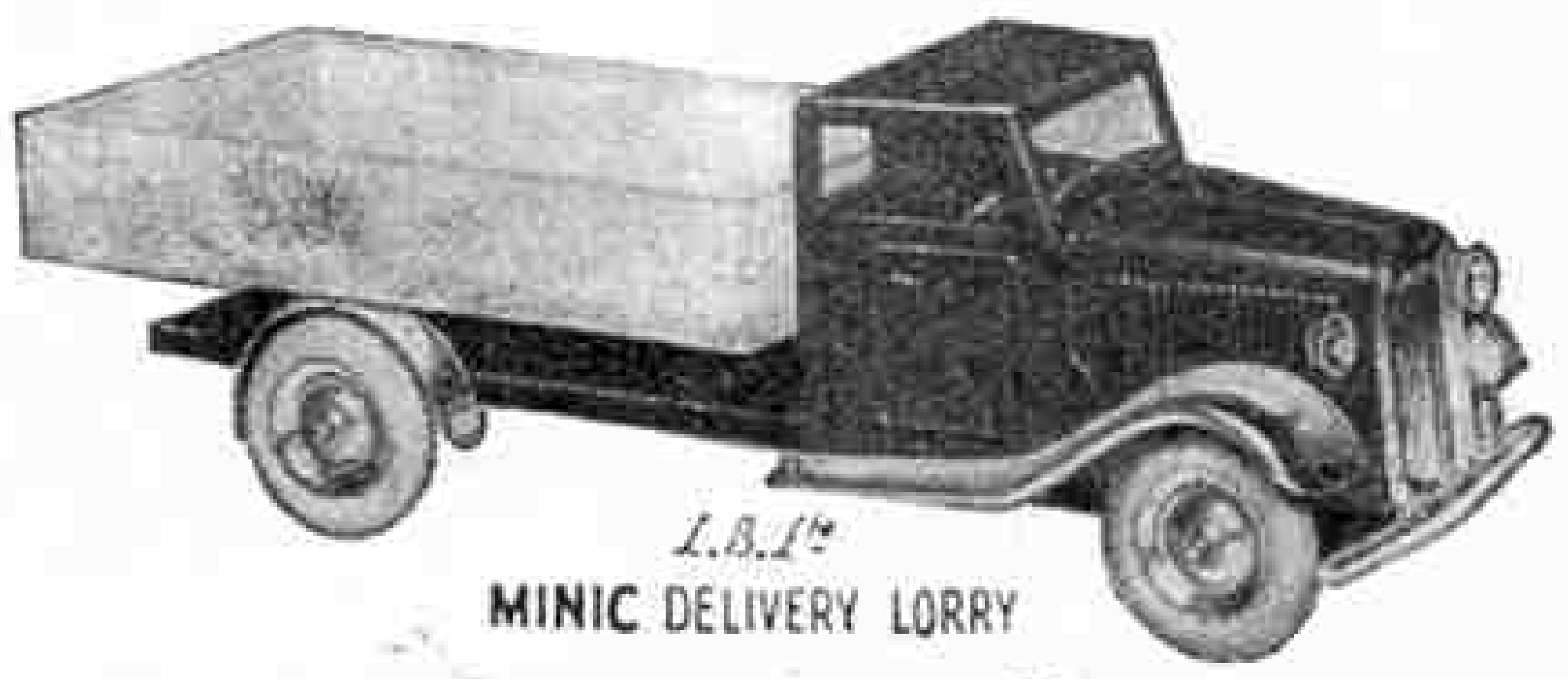
Length 5¼ ins. 1/6



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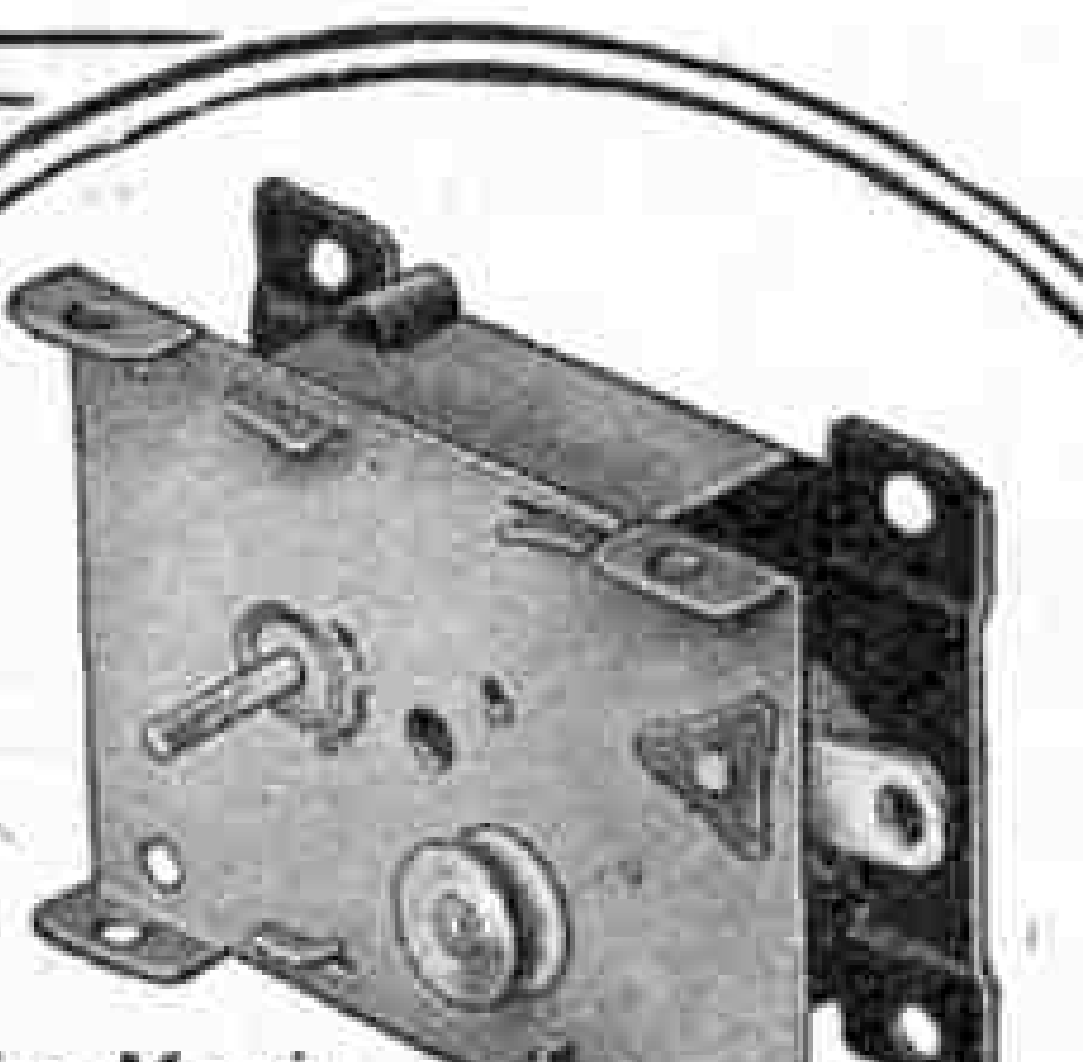
MINIC DELIVERY LORRY
Length 5 ins. 1/-

MINIC scale model clockwork toys are replicas in miniature of almost every type of vehicle on the road. Strongly constructed and fitted with powerful long running front wheel drive mechanism, they will run anywhere EVEN ON THE CARPET. The motor type are fitted with plated radiators, dummy lamps and bumpers, also plated disc wheels with rubber tyres. Each model is finished in a variety of colours and packed in an attractive box.

Regd. Trade Mark **Lines Bros. Ltd., Tri-ang Works, London, S.W.19** Regd. Trade Mark

MECCANO



The *Magic* Motor
This splendid new Motor is capable of driving models made with Meccano Outfits A, B and C
It costs only 2/-.

MOTORS FOR DRIVING MODELS

If you want to obtain the fullest enjoyment from the Meccano hobby you must operate your models by means of one of the Meccano Clockwork or Electric Motors listed below.

CLOCKWORK MOTORS

The *Magic* Motor (non-reversing) ...	Price	2/-
X Series Motor (non-reversing)... ...	,,	2/-
No. I Clockwork Motor (non-reversing)	,,	5/-
No. Ia Clockwork Motor (reversing) ...	,,	7/6
No. 2 Clockwork Motor (reversing) ...	,,	9/-

ELECTRIC MOTORS

No. El Electric Motor (6-volt). Non-reversing	Price	9/-
No. E6 Electric Motor (6-volt). Reversing ...	,,	15/6
No. E120 Electric Motor (20-volt). Non-reversing	,,	10/-
No. E20B Electric Motor (20-volt). Reversing	,,	18/6

TRANSFORMERS

The Transformers made by Meccano Limited provide a convenient and safe means of driving 6-volt or 20-volt Electric Motors and Train Sets from the mains supply where this is alternating current.

When ordering a Transformer or a Transformer-Rectifier the voltage and frequency of the supply must be stated. These particulars are given on the supply meter.

No. T6A Transformer (**Output 40 VA at 9/3½ volts**) **for 6-volt Electric Motors or 6-volt Trains.** Fitted with speed regulator and separate circuit for supplying current for eighteen 3½-volt lamps ... ... Price 22/6

No. T6 Transformer (**Output 25 VA at 9 volts**) **for 6-volt Electric Motors or 6-volt Trains.** Fitted with speed regulator ... ... Price 17/6

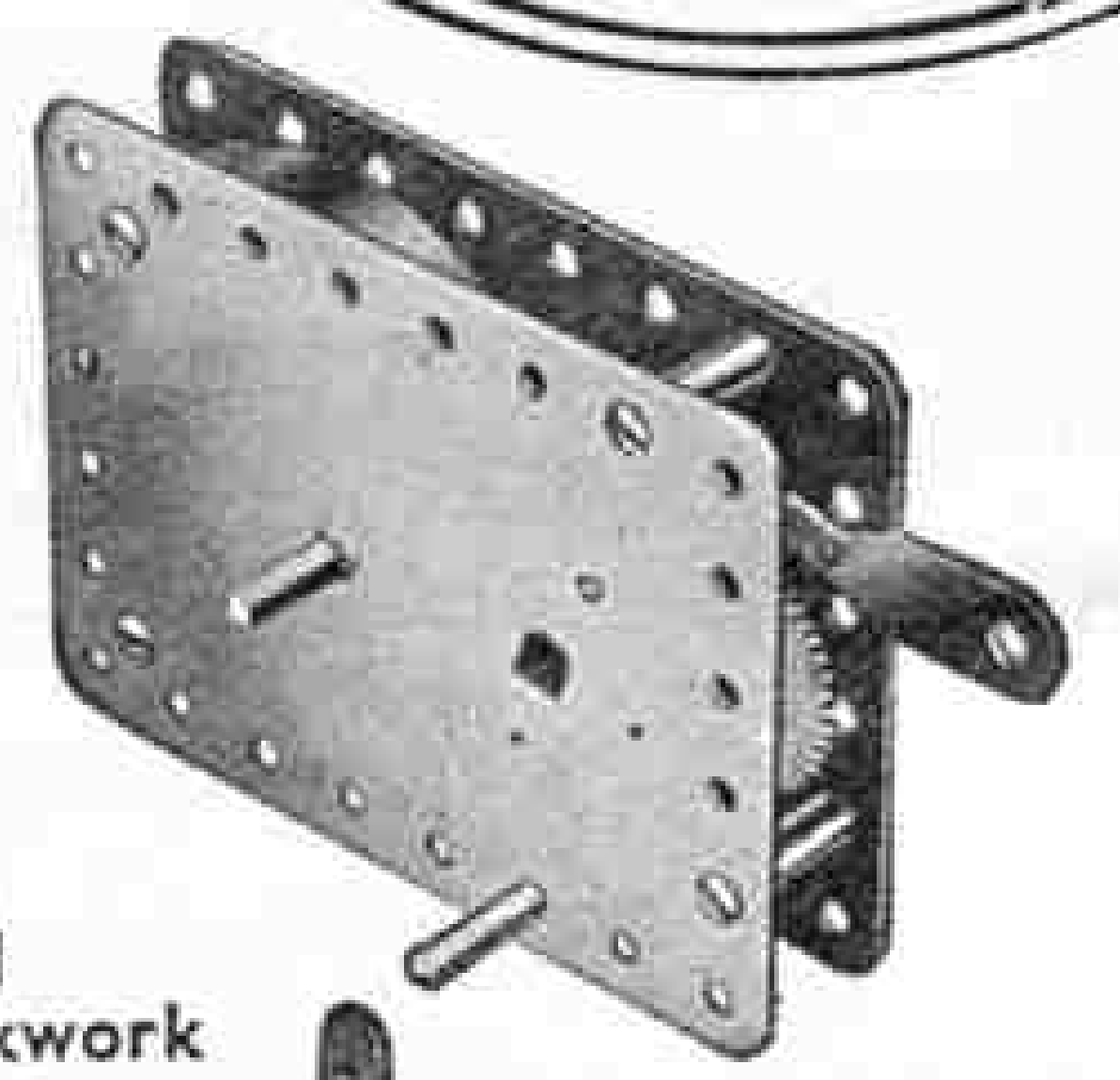
No. T6M Transformer (**Output 25 VA at 9 volts**) **for 6-volt Electric Motors or 6-volt Trains.** This is similar to No. T6, but is not fitted with a speed regulator ... Price 12/6

No. TR6 Transformer-Rectifier (**Output 6 volts at 1½ Amps.**) for use with Hornby No. EPM16 Special Tank Locomotive (6-volt, Permanent Magnet) ... ... Price 29/6

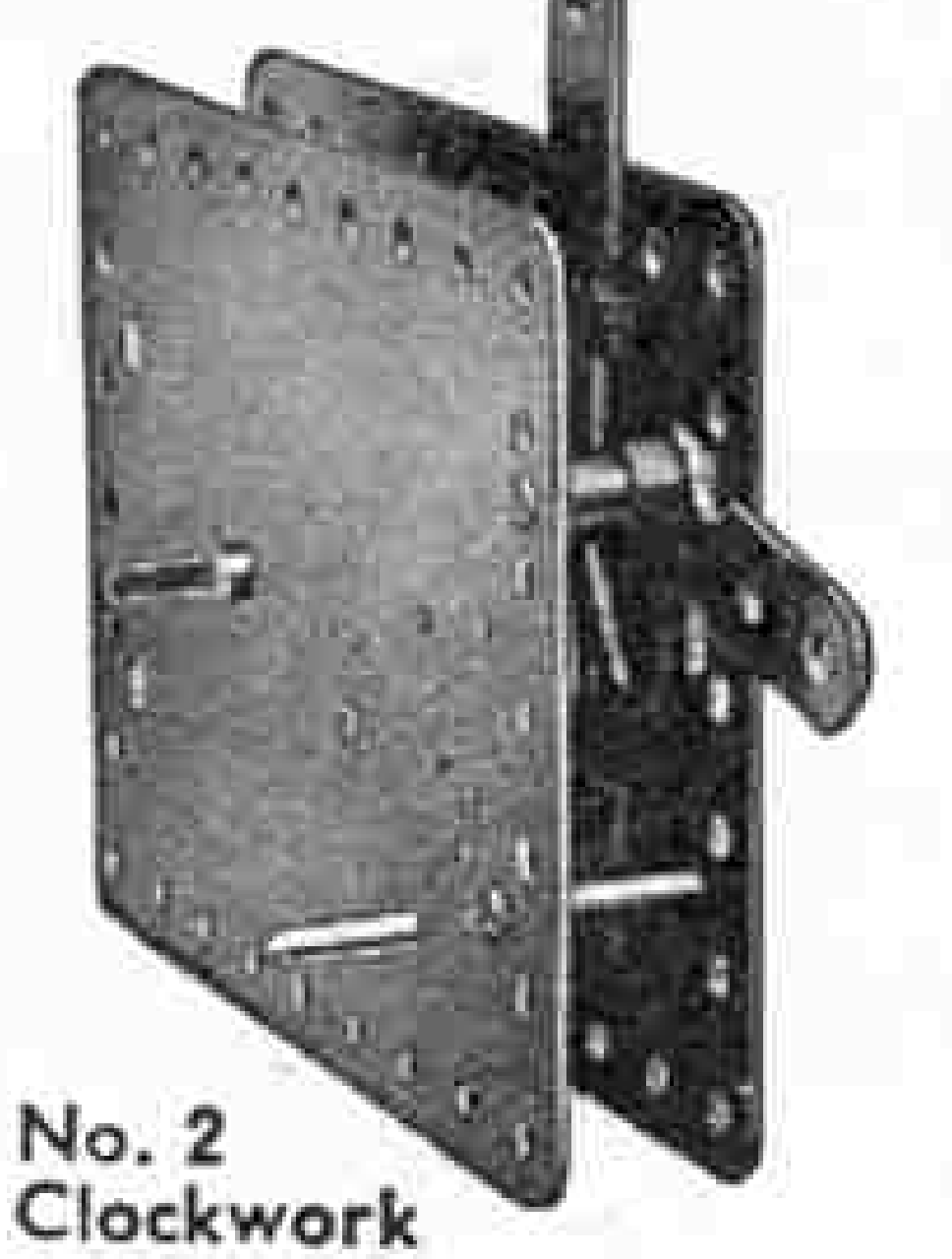
No. T20A Transformer (**Output 25 VA at 20/3½ volts**) **for 20-volt Electric Motors or 20-volt Trains.** Fitted with speed regulator and output sockets for lighting lamps. Price 22/6

No. T20 Transformer (**Output 20 VA at 20 volts**) **for 20-volt Electric Motors or 20-volt Trains.** Fitted with speed regulator ... ... Price 17/6

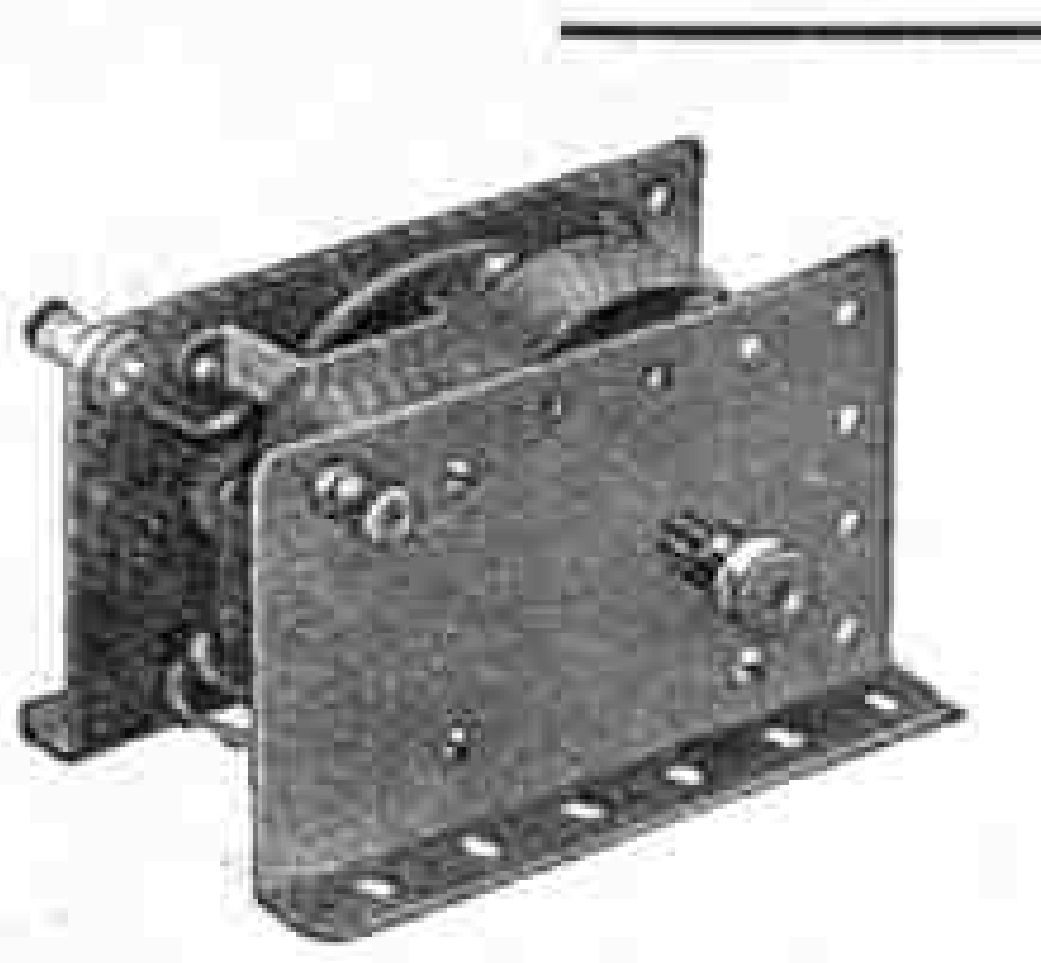
No. T20M Transformer (**Output 20 VA at 20 volts**) **for 20-volt Electric Motors or 20-volt Trains.** This is similar to No. T20 but is not fitted with speed regulator... Price 12/6



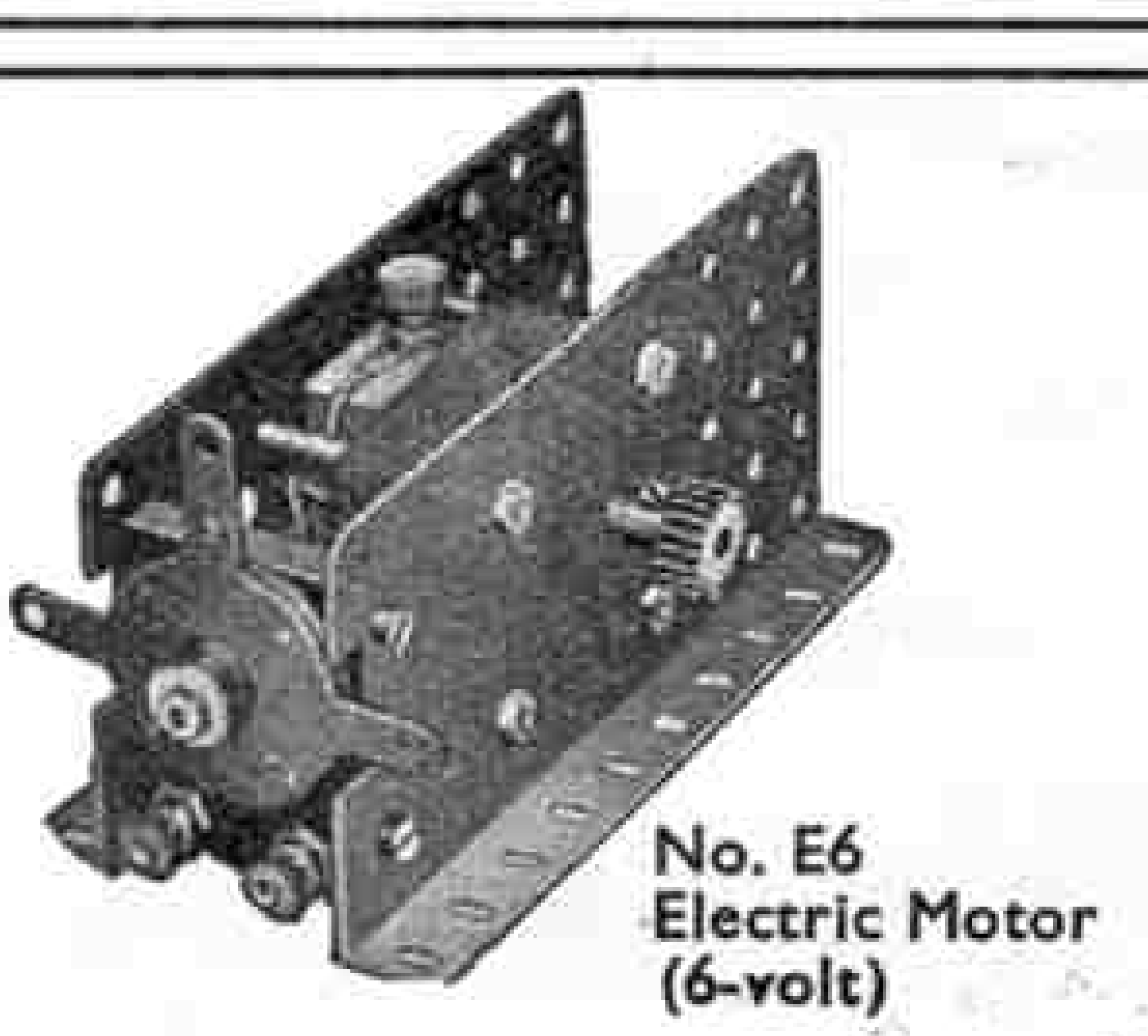
No. 1 Clockwork Motor



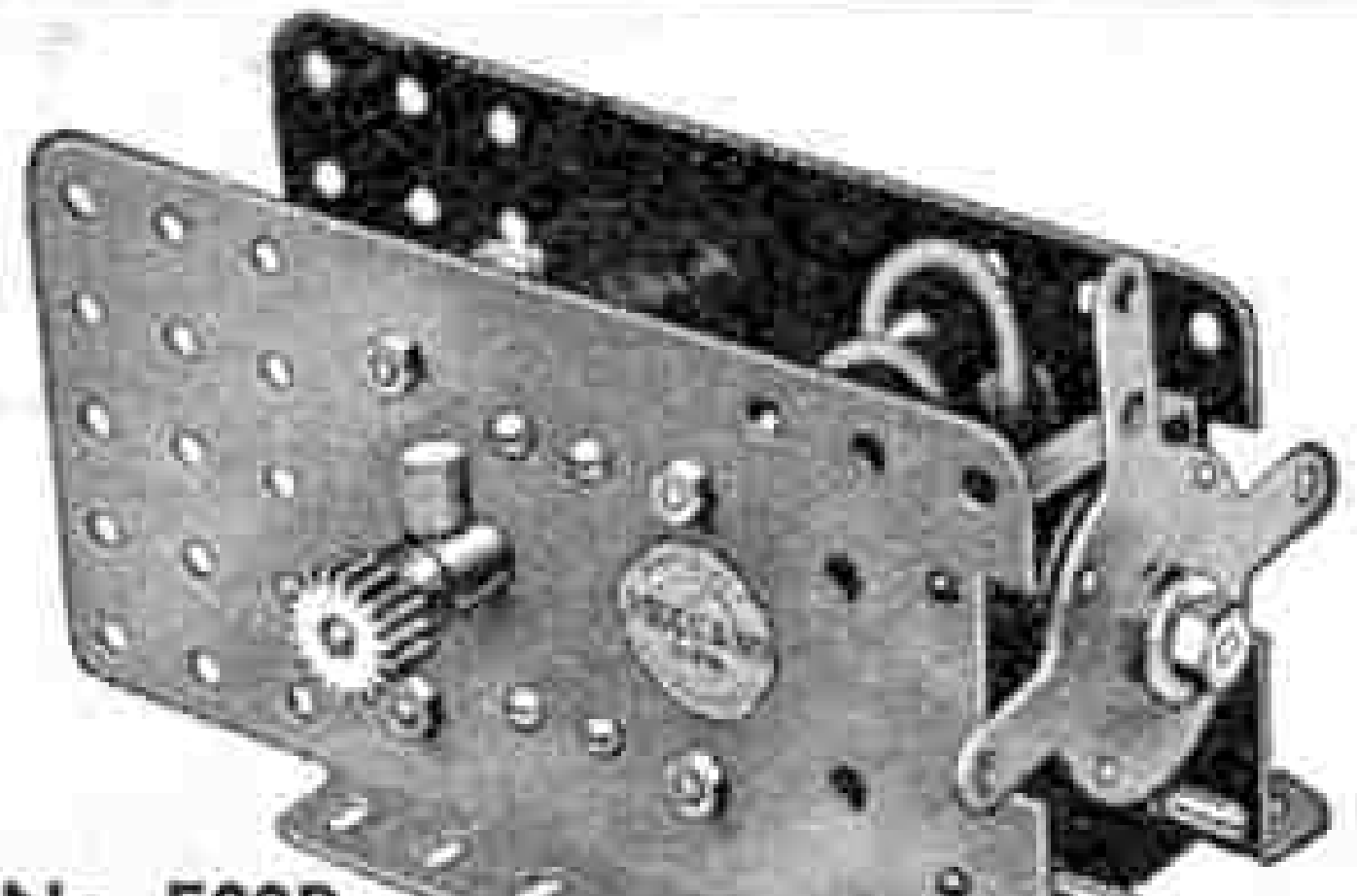
No. 2 Clockwork Motor



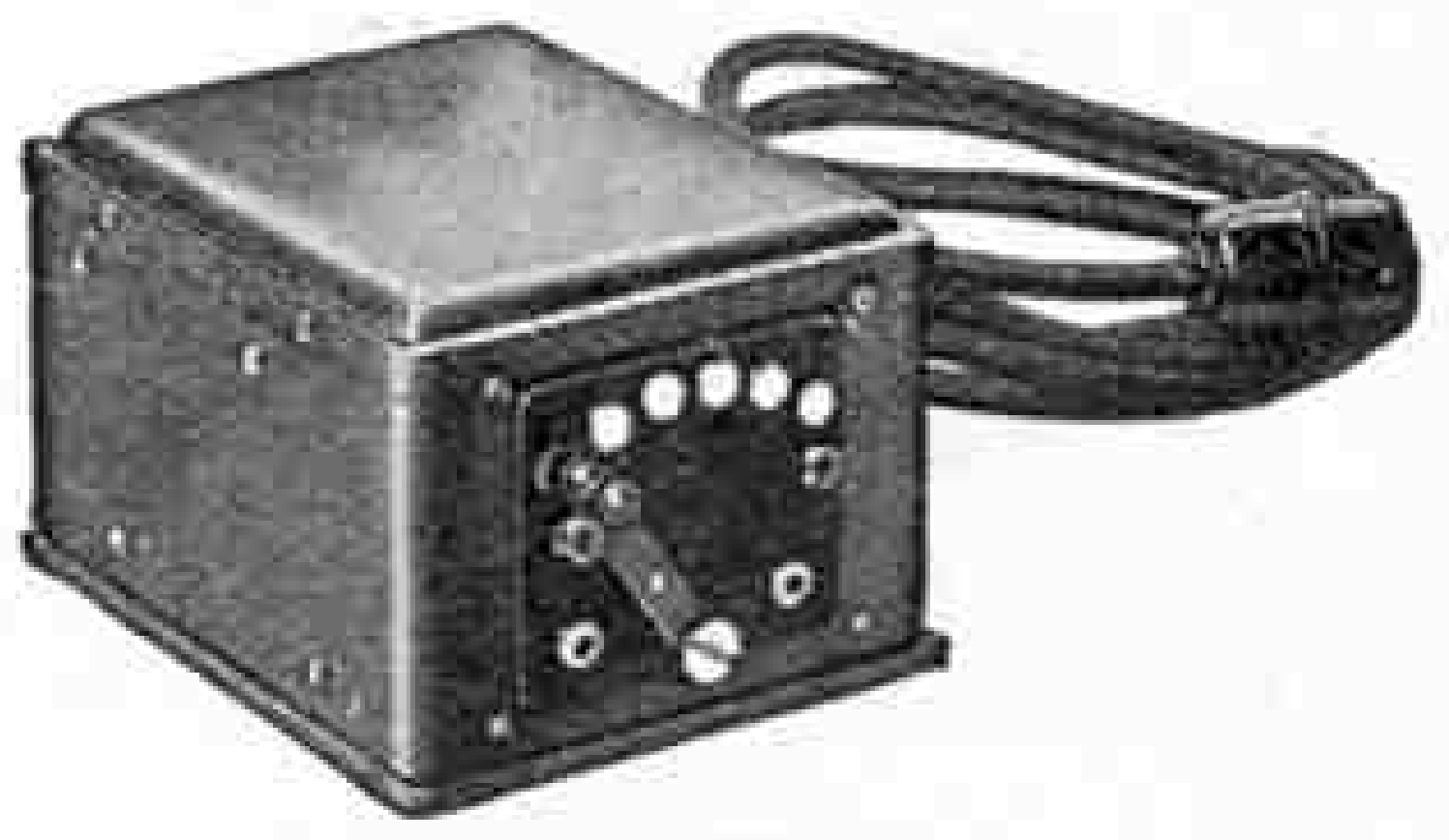
No. E1 Electric Motor (6-volt)



No. E6 Electric Motor (6-volt)



No. E20B Electric Motor (20-volt)



No. T20 Transformer

A NEW

ELECTRIC LIGHTING SYSTEM

FOR HORNBY ACCESSORIES

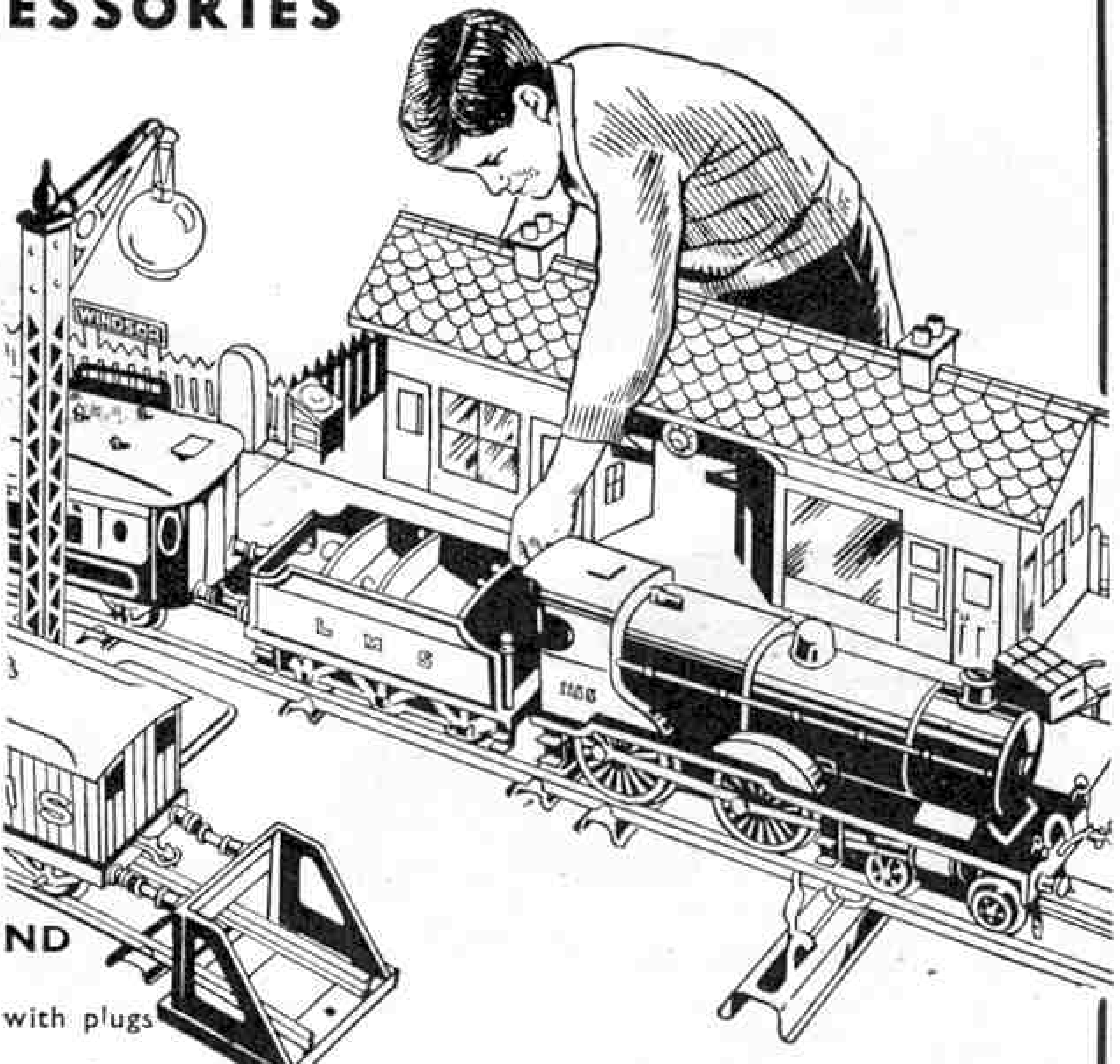
BRILLIANT, SAFE AND INEXPENSIVE

The following is a complete list of the Hornby Accessories available fitted for electric lighting on the new and simplified system adopted this season. These accessories are specially designed for lighting from the 3½-volt circuit of a Meccano T20A or T6A Transformer, and with each of these Transformers are packed for the purpose a pair of Plugs, an Earthing Clip and a coil of Wire, together with full instructions. The Accessories can also be lighted from an accumulator. Each Accessory is accompanied by an Earthing Clip and a Leaflet giving full instructions for use. Lamp bulbs are not provided with the Accessories.

No. E1E Engine Shed	Price	15/6	No. 2E Signal Gantry	Price	12/9
No. E2E Engine Shed	,,	23/-	No. E1E Level Crossing ...	,,	5/3
No. 2E Station		9/3	No. E2E Level Crossing ...	,,	9/-
Island Platform E	,,	6/3	No. 1E Buffer Stops	,,	1/6
No. 2E Goods Platform... ...	,,	11/6	No. 2E Buffer Stops	,,	6/-
No. 2E Signal Cabin	,,	4/3	No. 2E Water Tank	,,	6/6
No. 2E Signal	,,	2/9	No. 1E Lamp Standard	,,	2/11
No. 2E Double Arm Signal ...	,,	3/11	No. 2E Lamp Standard	,,	3/3
No. 2E Junction Signal	,,	6/-			

The following items used in connection with the new system of Accessories lighting are available:

Plugs for sockets of Transformers T20A and T6A ... ... Price per pair, 6d.
Earthing Clips ... ... each 3d. Connecting Wire ... Price per coil 4d.

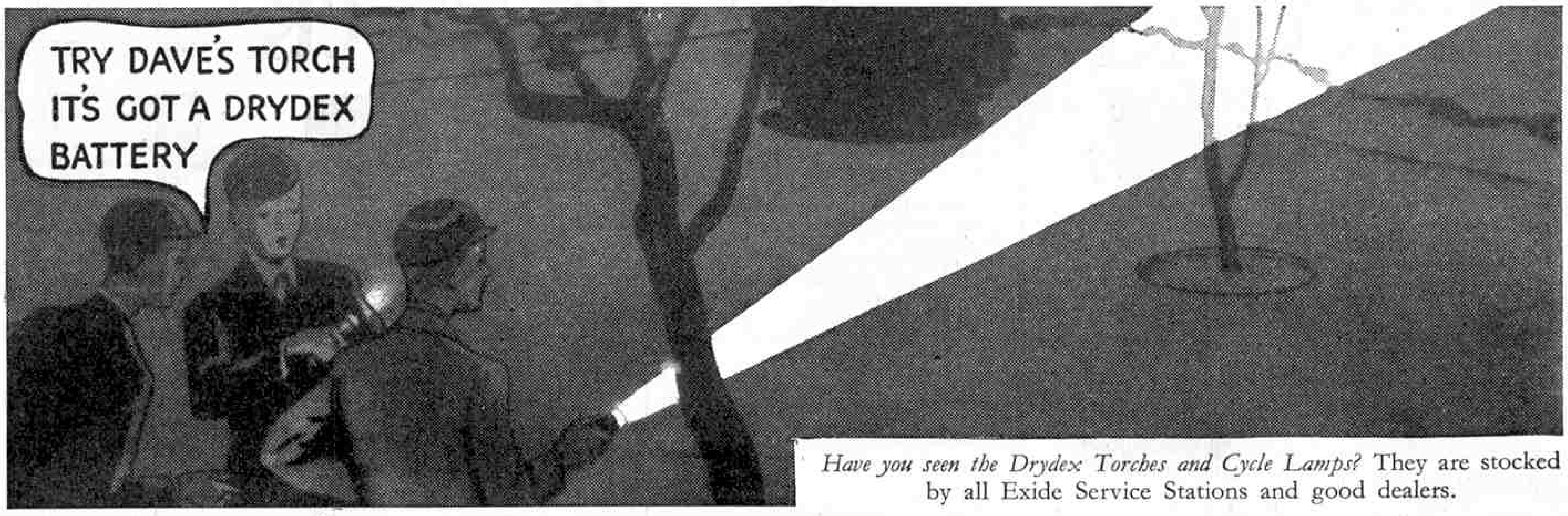


ACCESSORIES FOR LIGHTING WITH DISTRIBUTION BOX AND FLEXIBLE LEADS

The old type Accessories fitted for lighting by means of a Distribution Box and Flexible Leads with plugs and sockets are still available at the following prices:

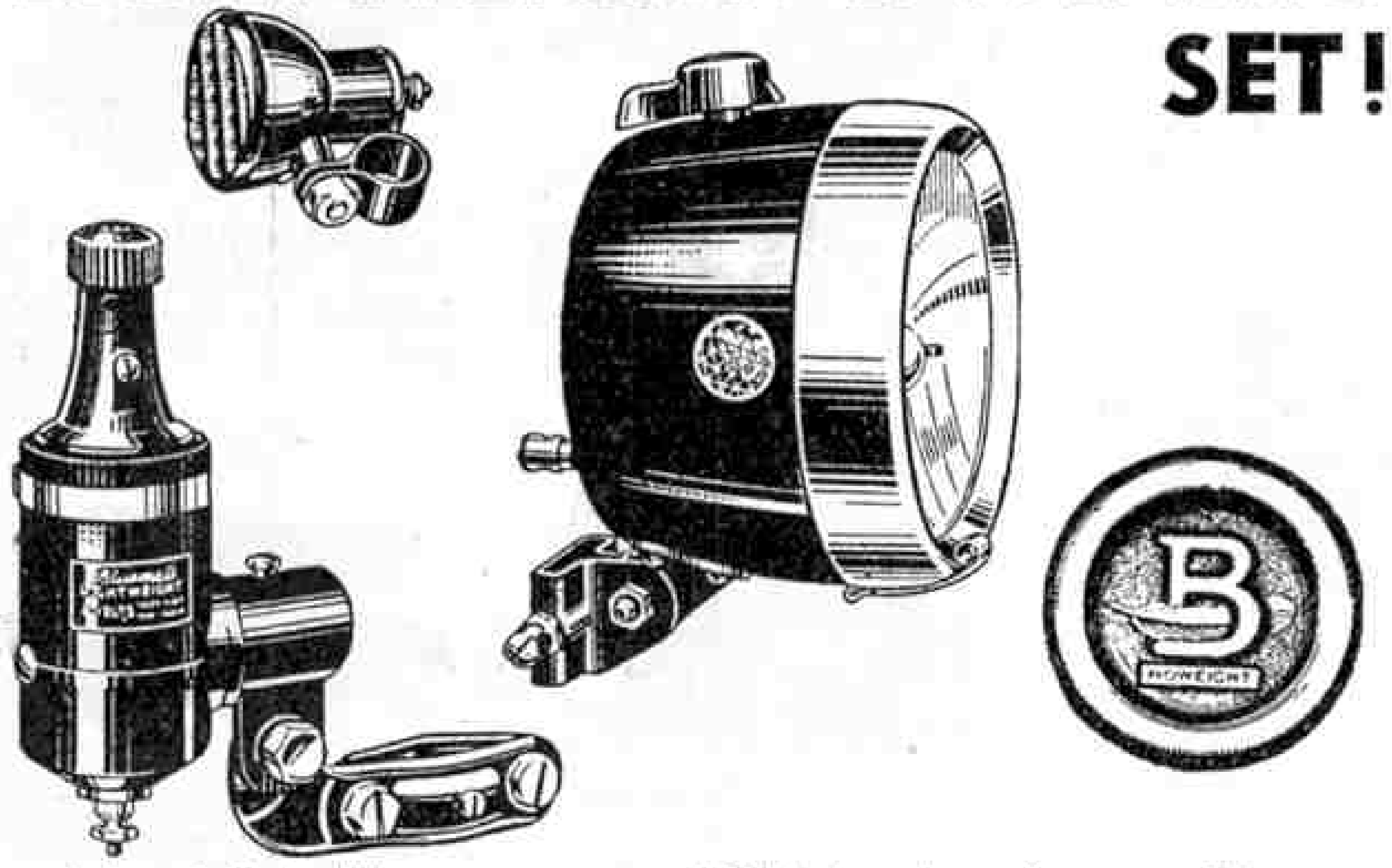
	Price		Price		Price
No. E1E Engine Shed ...	18/6	No. 2E Double Arm Signal	6/6	No. 2E Water Tank ...	10/-
No. E2E Engine Shed ...	26/-	No. 2E Junction Signal ...	9/-	No. 1E Lamp Standard ...	3/6
No. 2E Station	11/6	No. 2E Signal Gantry ...	18/-	No. 2E Lamp Standard ...	4/3
Island Platform E	9/-	No. E1E Level Crossing ...	7/-	Flexible Leads, 9", 18", and 36". Prices 1/4, 1/5 and 1/6 respectively.	
No. 2E Goods Platform ...	15/-	No. E2E Level Crossing ...	11/-		
No. 2E Signal Cabin ...	5/6	No. 1E Buffer Stops ...	2/-		
No. 2E Signal	4/3	No. 2E Buffer Stops ...	7/-	Distribution Box ... Price	2/6

MECCANO LTD.
BINNS ROAD, LIVERPOOL 13


TRY DAVE'S TORCH
IT'S GOT A DRYDEX BATTERY

Have you seen the Drydex Torches and Cycle Lamps? They are stocked by all Exide Service Stations and good dealers.

"LIGHTWEIGHT" DYNAMO SET!



A head light like a motor car! This is what the new Bluemel "Lightweight" Dynamo set gives you. You generate your own electric power as you ride.

- Dynamo over 20% lighter than average.
- Made of shock-proof material.
- Well-designed dynamo ensures smooth running.
- Modern black and chromium twin-bulb headlamp with two-way switch.
- Combined rear lamp and officially approved reflector—can be used as either.

PRICE
23/-
COMPLETE
Less Battery

Bluemel's

BLUEMEL BROS. LTD.,
Dept. 27, WOLSTON, near COVENTRY.

Send postcard for complete new list of "Featherweight" and "Noweight" Accessories — mudguards, reflectors, lamps, horns, etc.

Price 5/- Net

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12 colour plates and 105 illustrations from photographs.

Every kind of craft from a Roman galley to the "Queen Mary" clearly described, also colour plate of distinctive Funnels and House flags of shipping companies.

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Chandos House, Bedford Court, London, W.C.2

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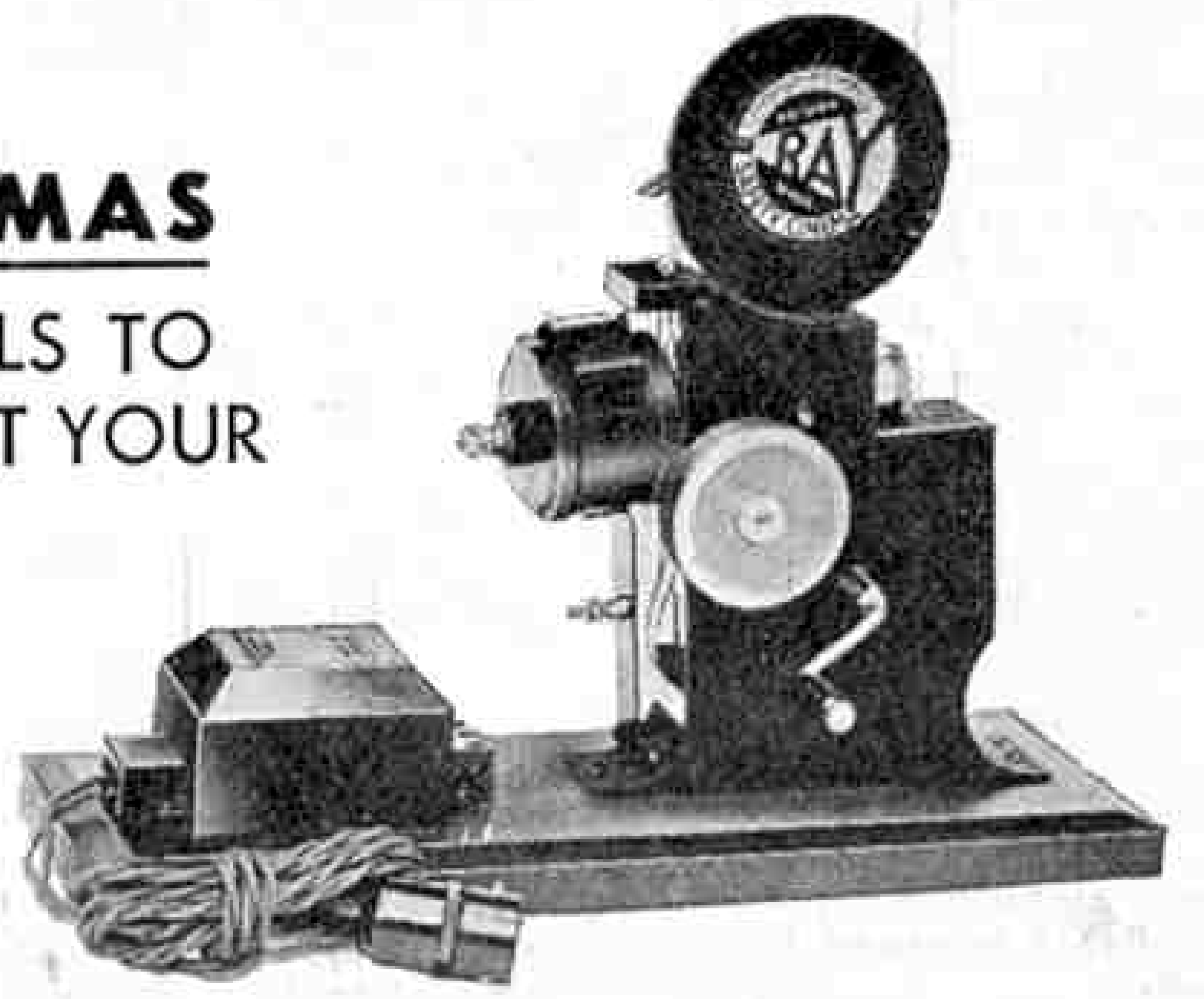

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HORNBY SERIES

HORNBY ROLLING STOCK

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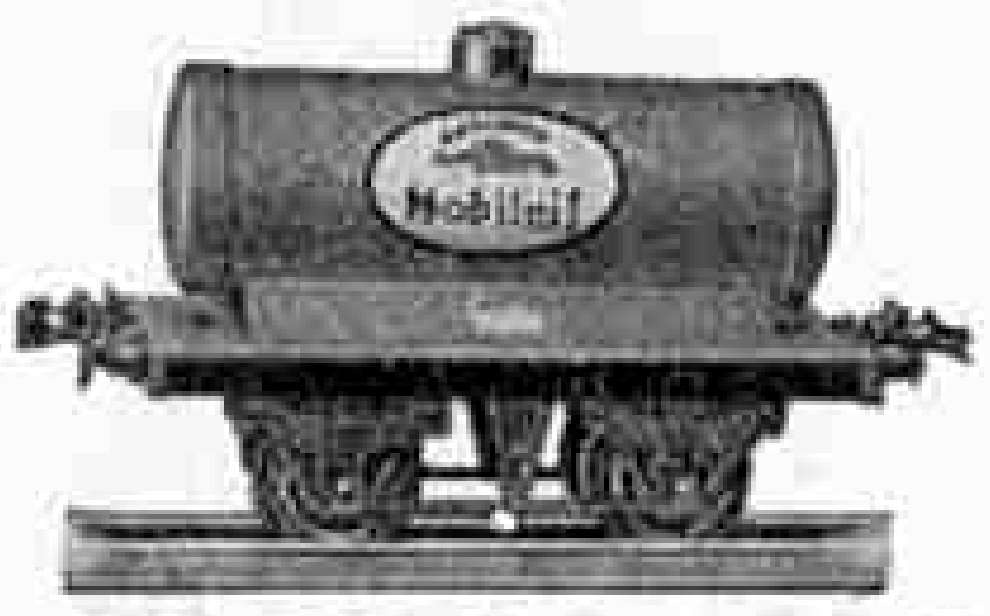
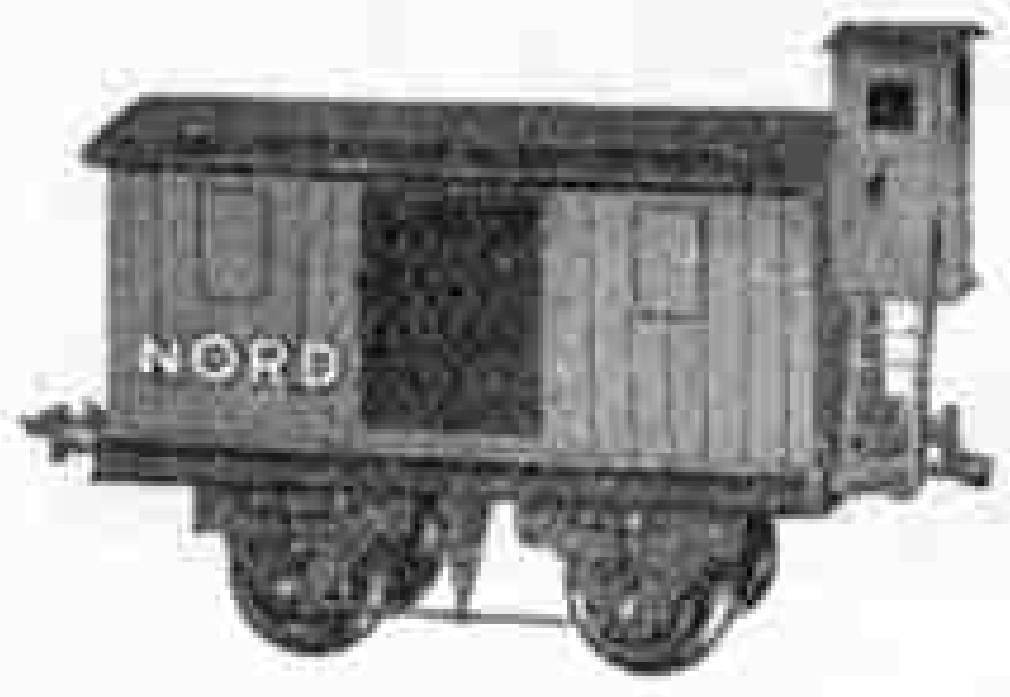
Now is the time to add to your Hornby Railway. Every boy knows that a real railway system is constantly expanding and developing. New rolling stock and new equipment are added; new tracks are laid; new stations, signal cabins and goods sheds are built; new tunnels and viaducts are constructed—every effort is made to cater for modern requirements. Your Hornby railway, too, can be run in the same progressive manner. One by one you can add Coaches, Trucks, Wagons and Vans of the latest types; and Stations, Signals, Bridges, Turntables and Engine Sheds that will gradually convert your present Hornby railway into a really fine model railway system.

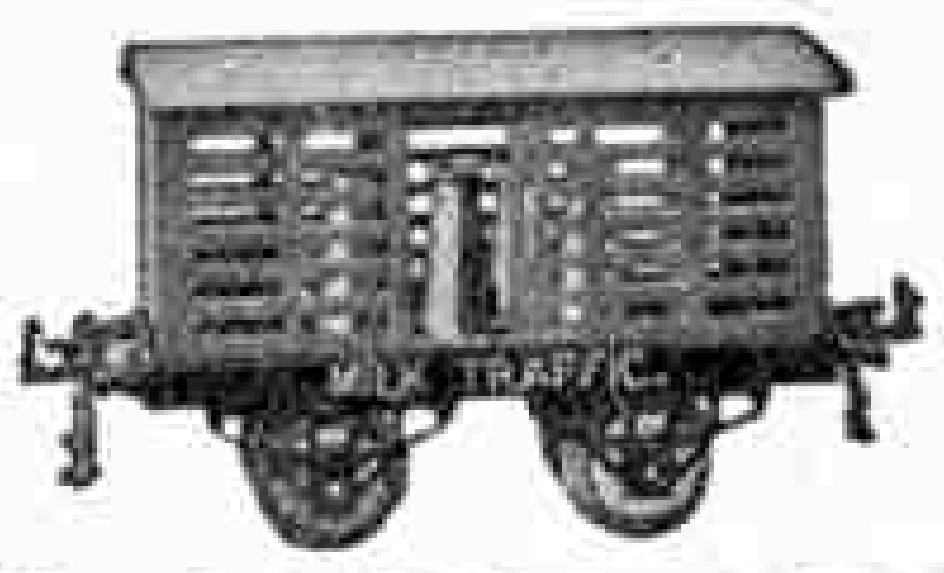
Ask your dealer to show you the full range of Hornby Rolling Stock and Accessories.



OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/–**



BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/–**



No. I MILK TRAFFIC VAN
Fitted with sliding doors. Complete with milk cans. Price **2/11**

SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/–**

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Beautifully enamelled in yellow and red. Price **1/6**

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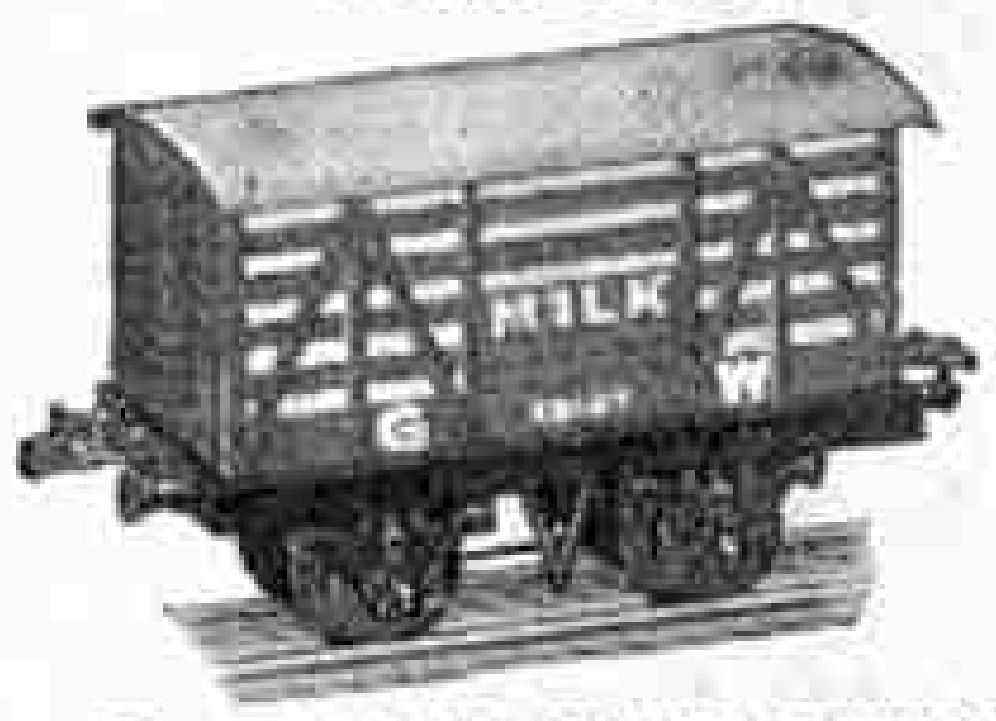
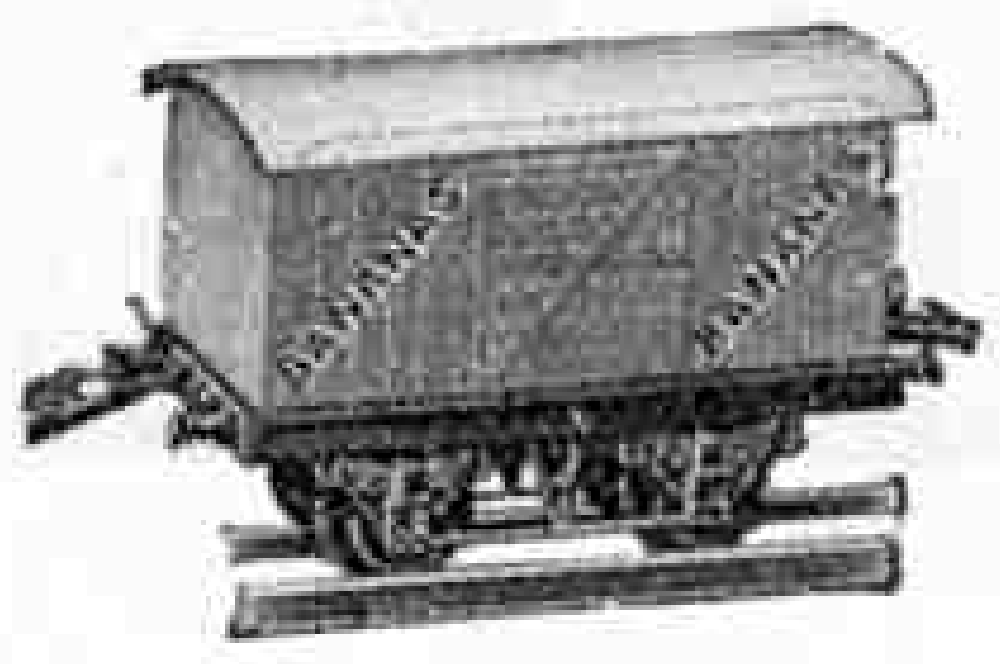
Finished in red. With opening doors. Price **2/9**

BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **3/6**

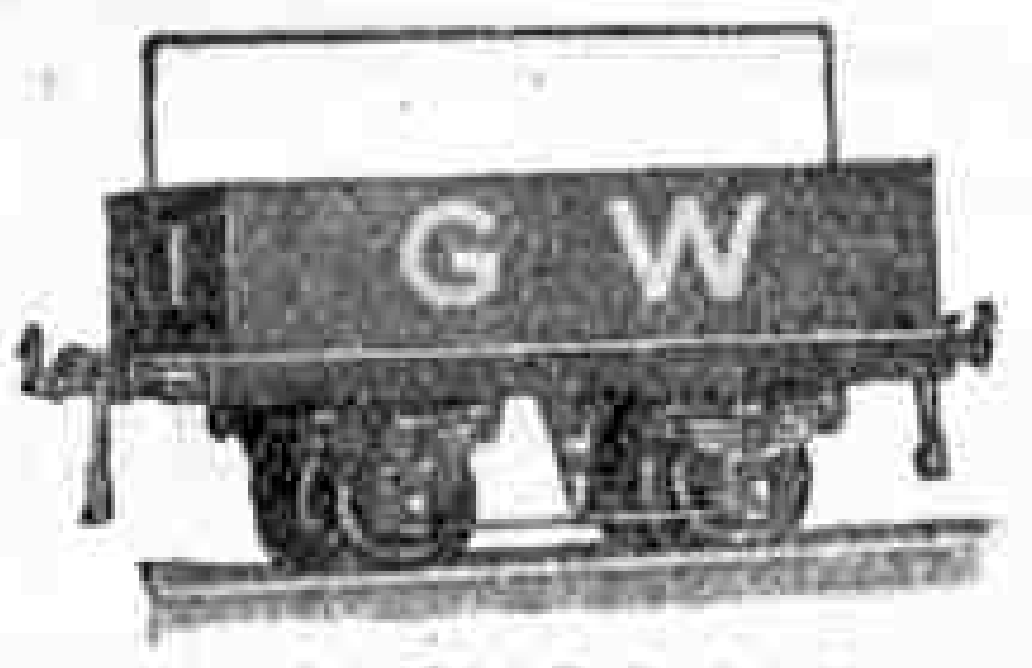


No. O MILK TRAFFIC VAN
An attractive model. Available lettered G.W. only. Price **1/9**

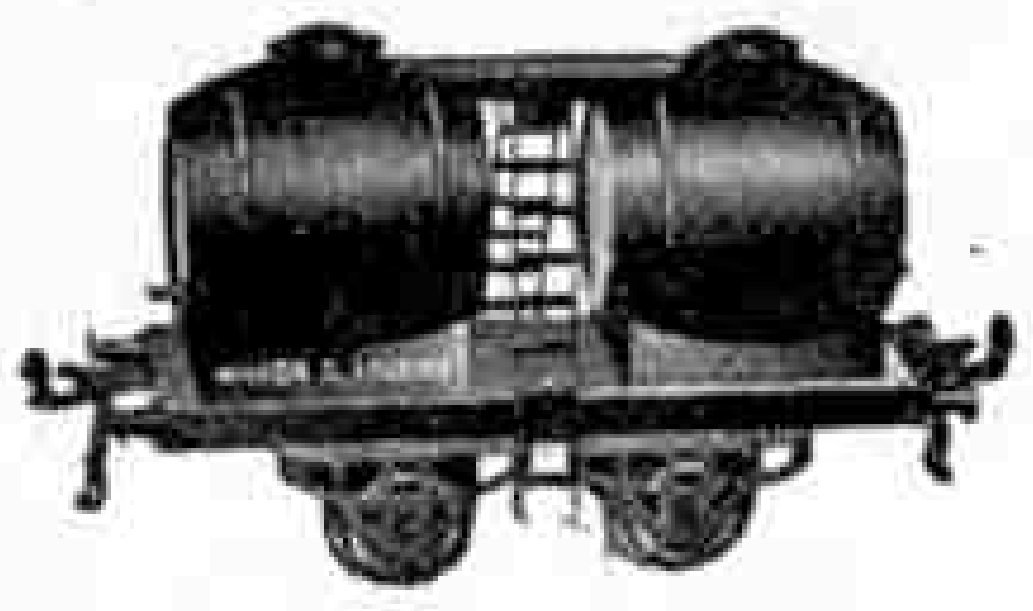
PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/–**



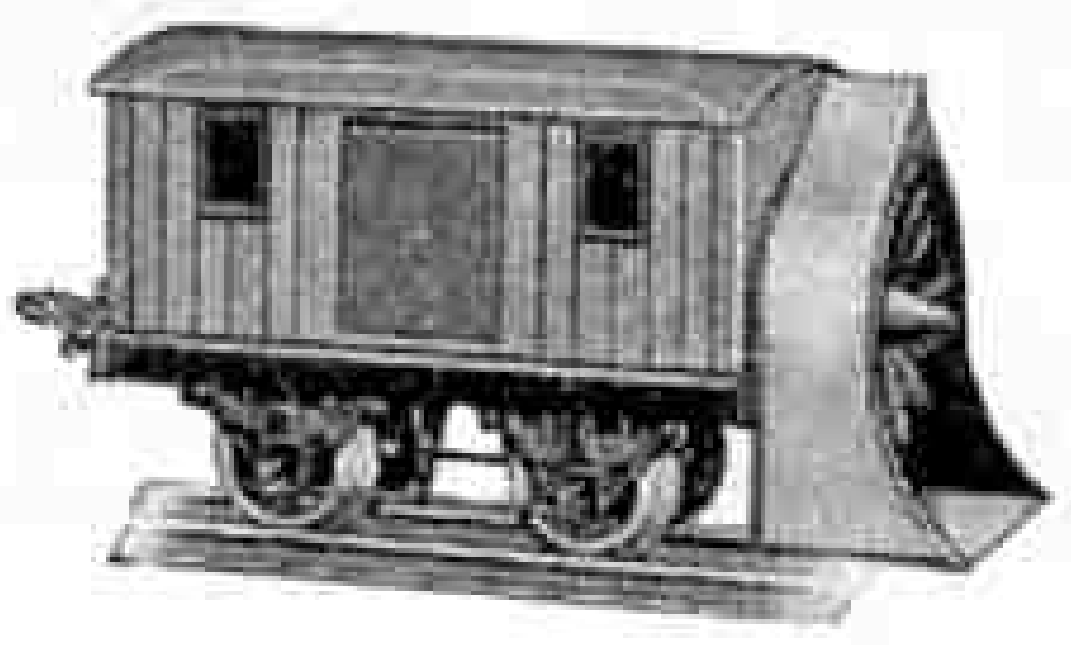
No. I BANANA VAN
An attractive model, finished in yellow and red. Price **2/9**



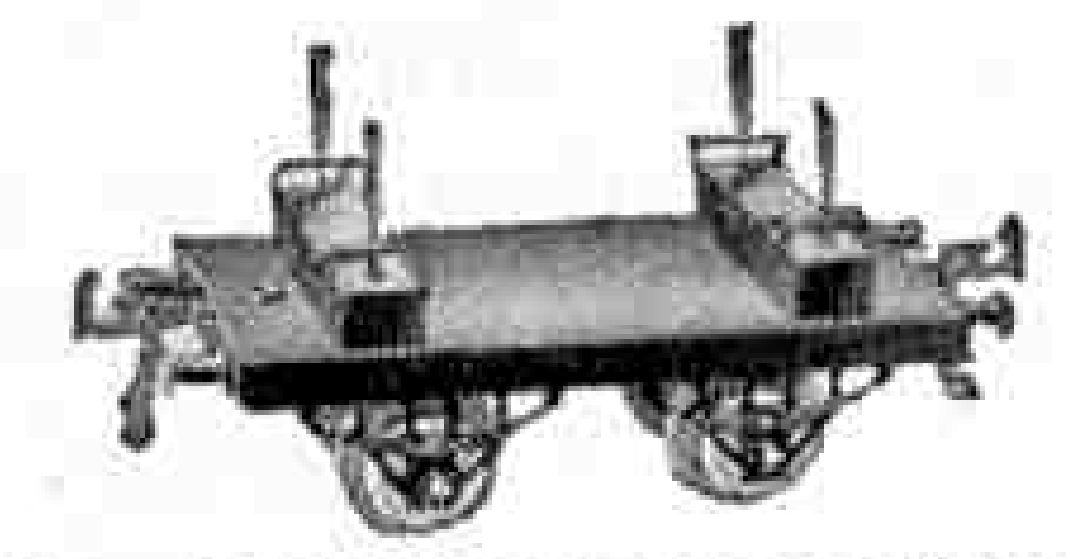
***OPEN WAGON "B"**
Similar to Hornby Wagon No. 1 but fitted with centre tarpaulin supporting rail. Price **2/–**



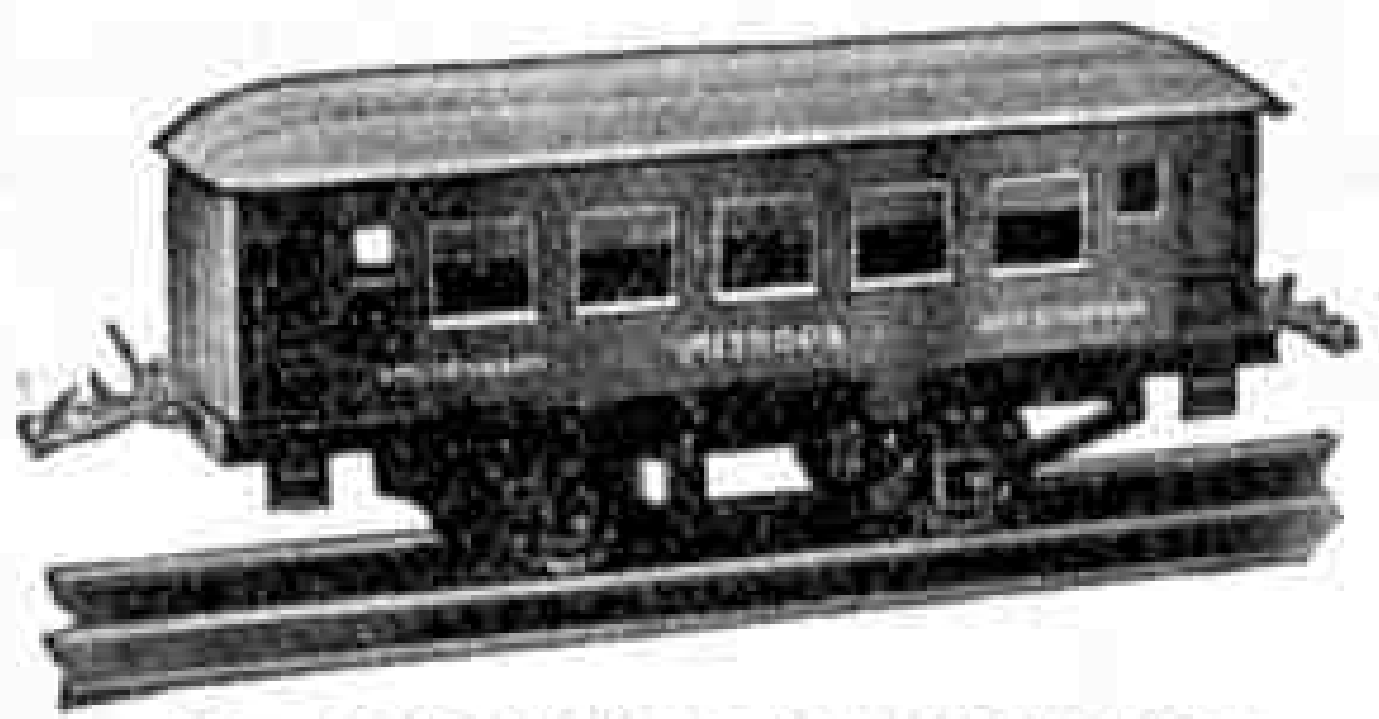
WINE WAGON DOUBLE BARREL
An attractive model artistically enamelled in red and green. Price **4/6**



SNOW PLOUGH
With revolving plough. Price **3/9**

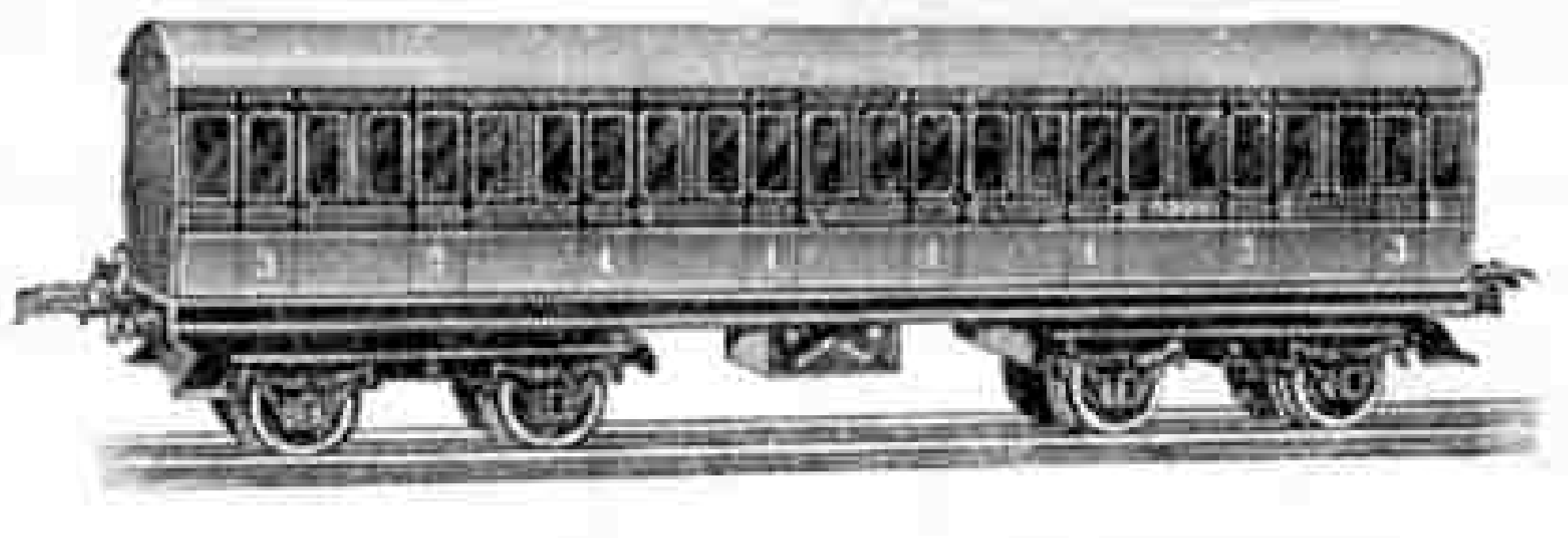


No. I LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Price **1/6**

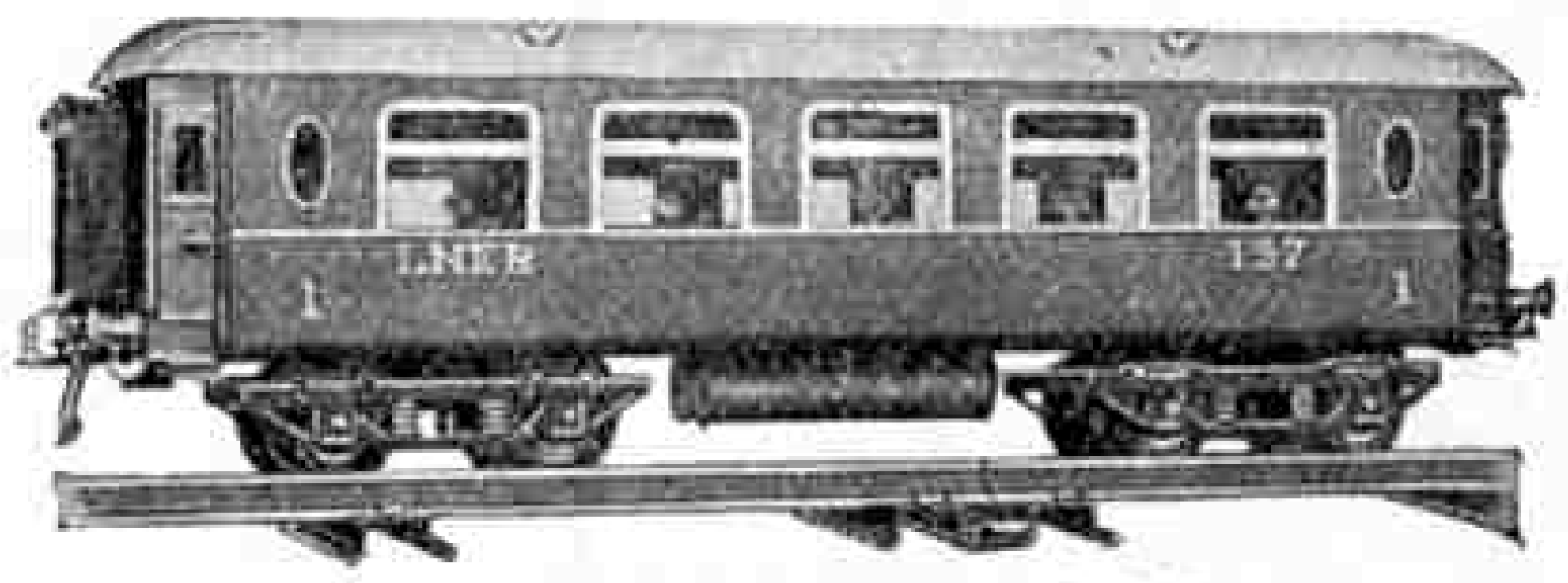


No. O MITROPA COACH
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**

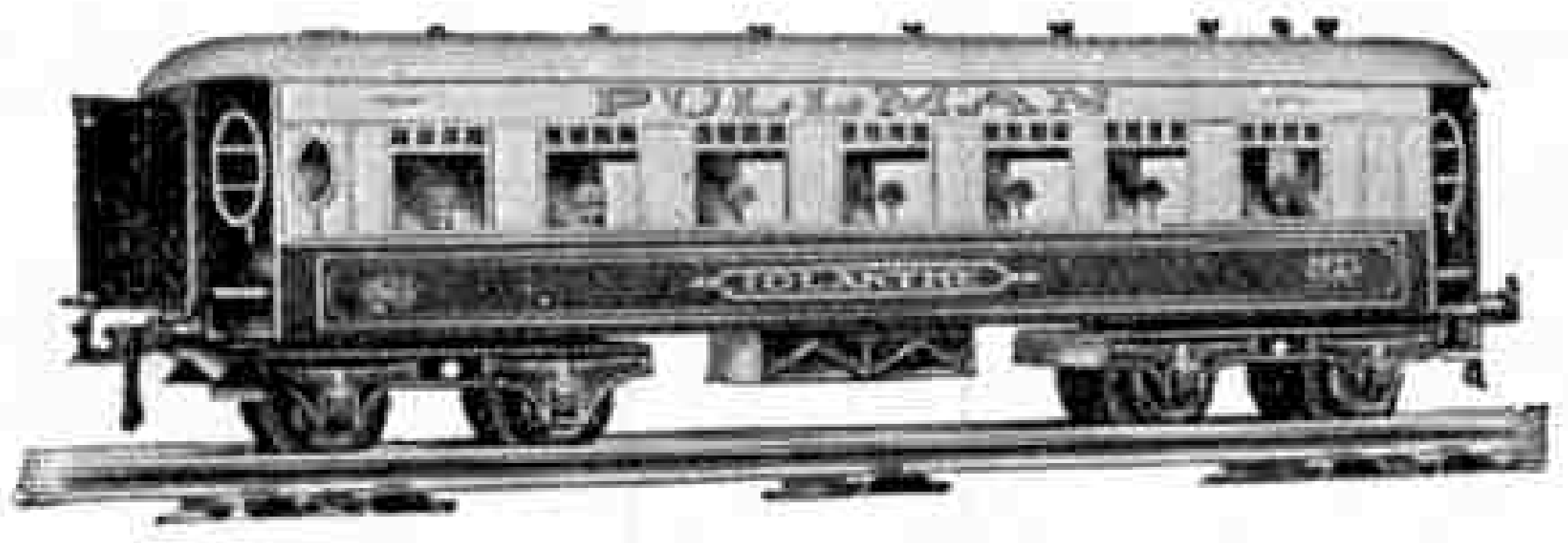
COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**



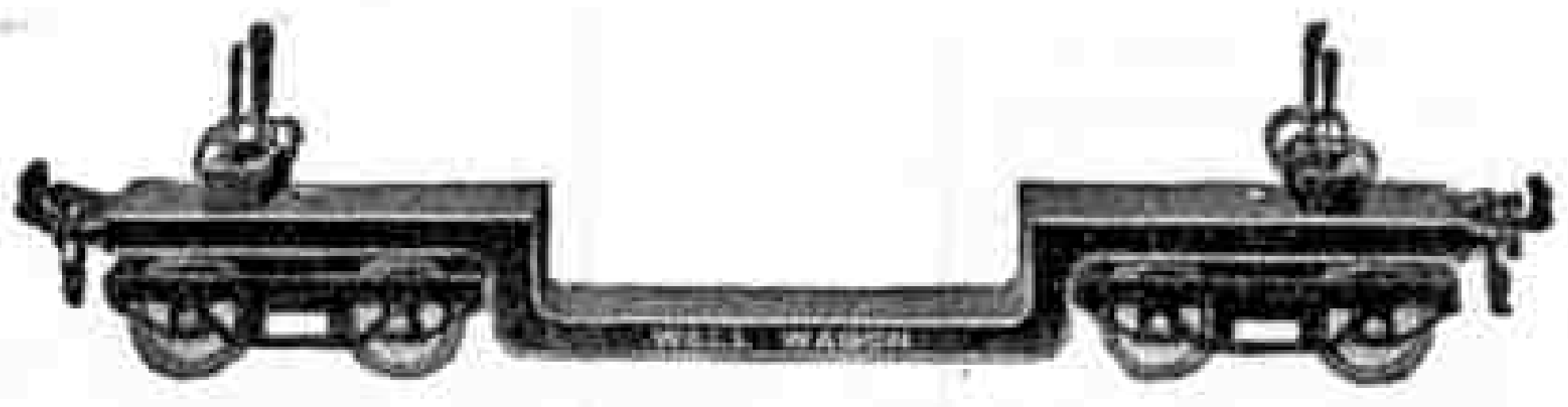
***No. 2 PASSENGER COACH**
Suitable for 2 ft. radius rails only. First-third, or Brake-third. Price **7/6**



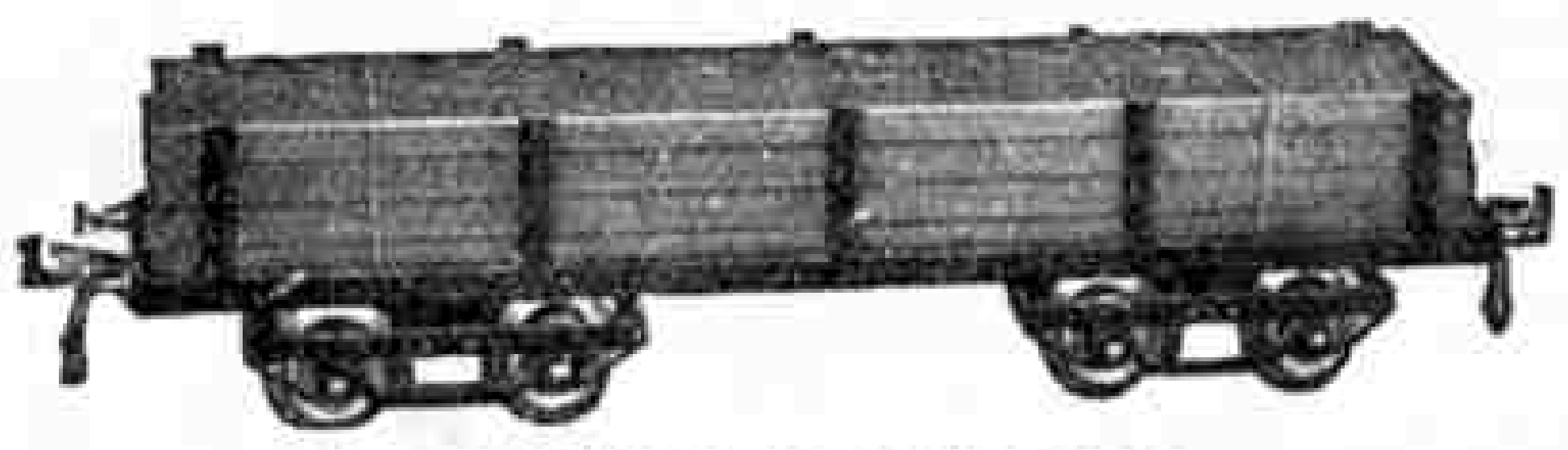
No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.N.E.R. (as illustrated) enamelled brown, and L.M.S. enamelled maroon. Suitable for 2-ft. radius rails only. Price **9/6**



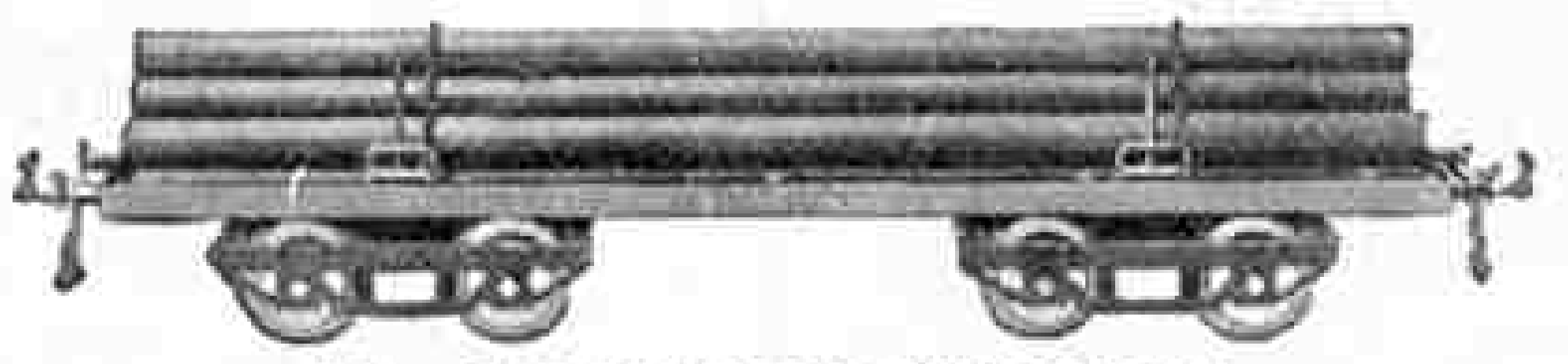
No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **13/–**



TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **3/11**



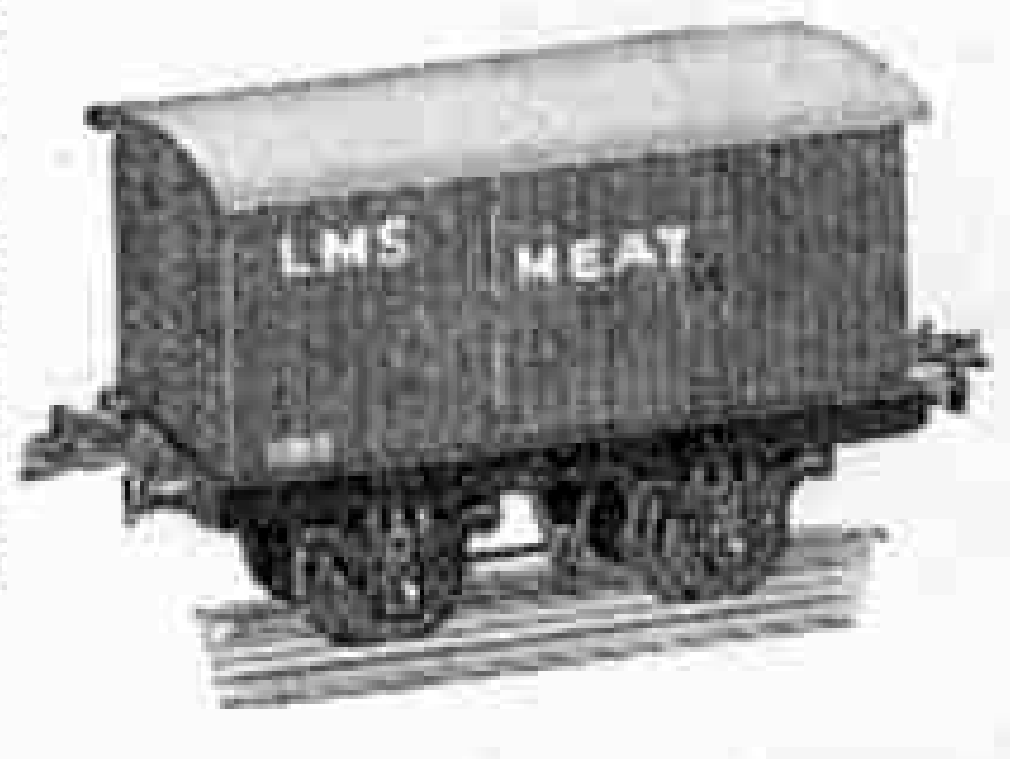
No. 2 TIMBER WAGON
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **2/6**



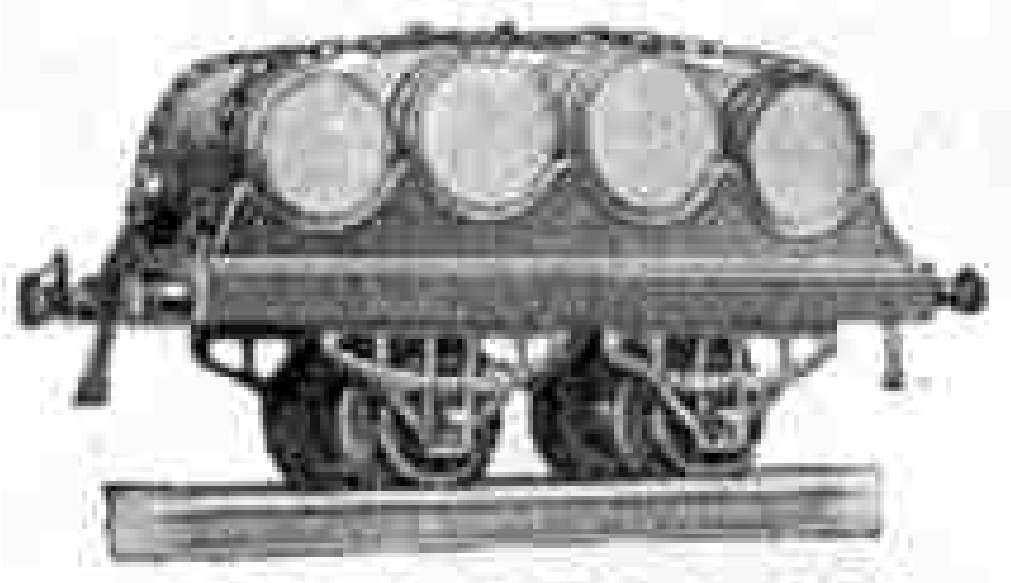
No. 2 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **2/11**

**In L.M.S., L.N.E.R., G.W. or S.R. lettering.*

PETROL TANK WAGON "SHELL"
Finished in red. Price **2/–**

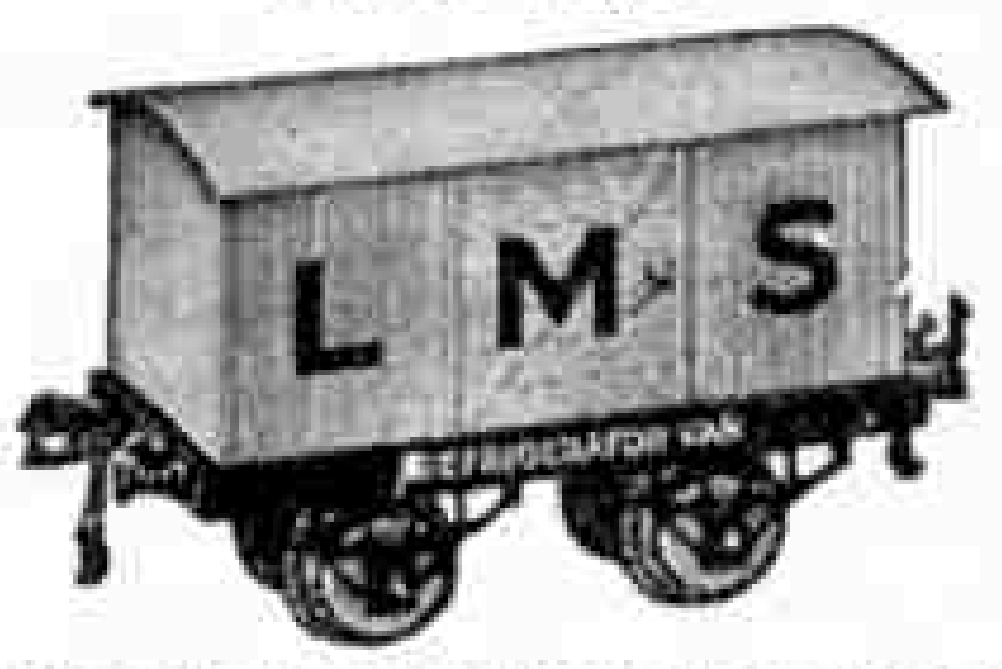


MEAT VAN
This is a very realistic model. Available lettered L.M.S. only. Price **1/9**

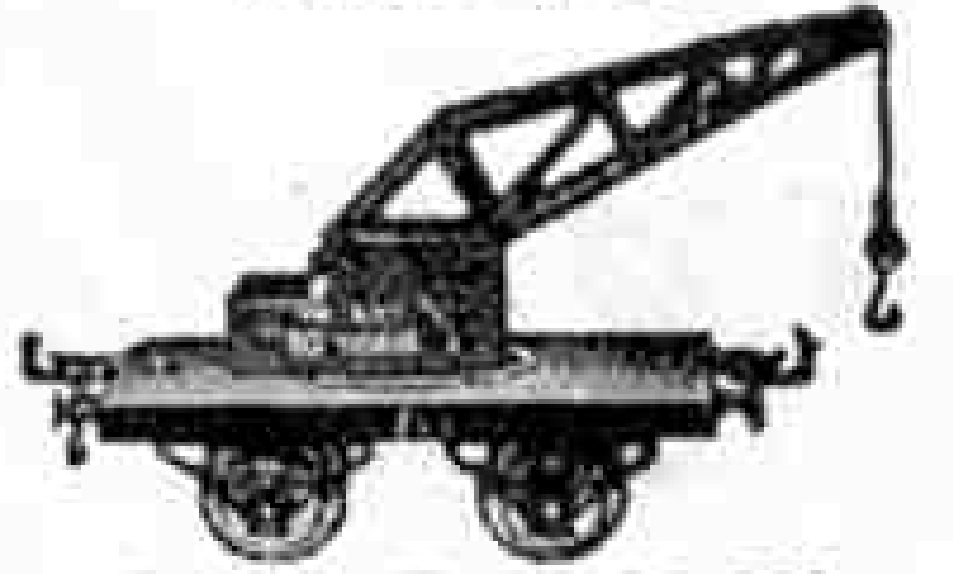


BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/6**

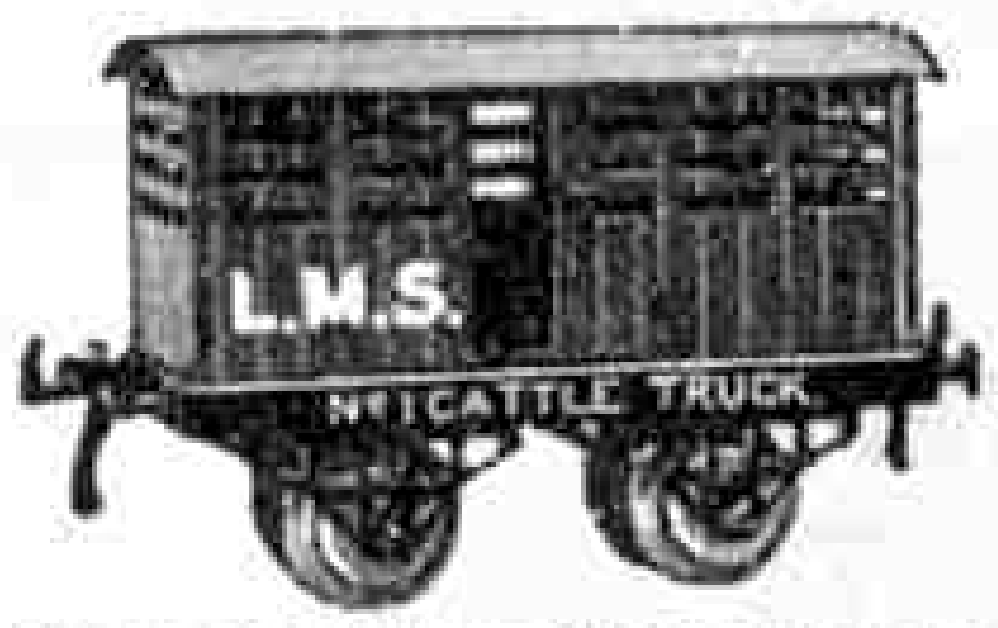
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. Lettered "Nord." Price **2/6**



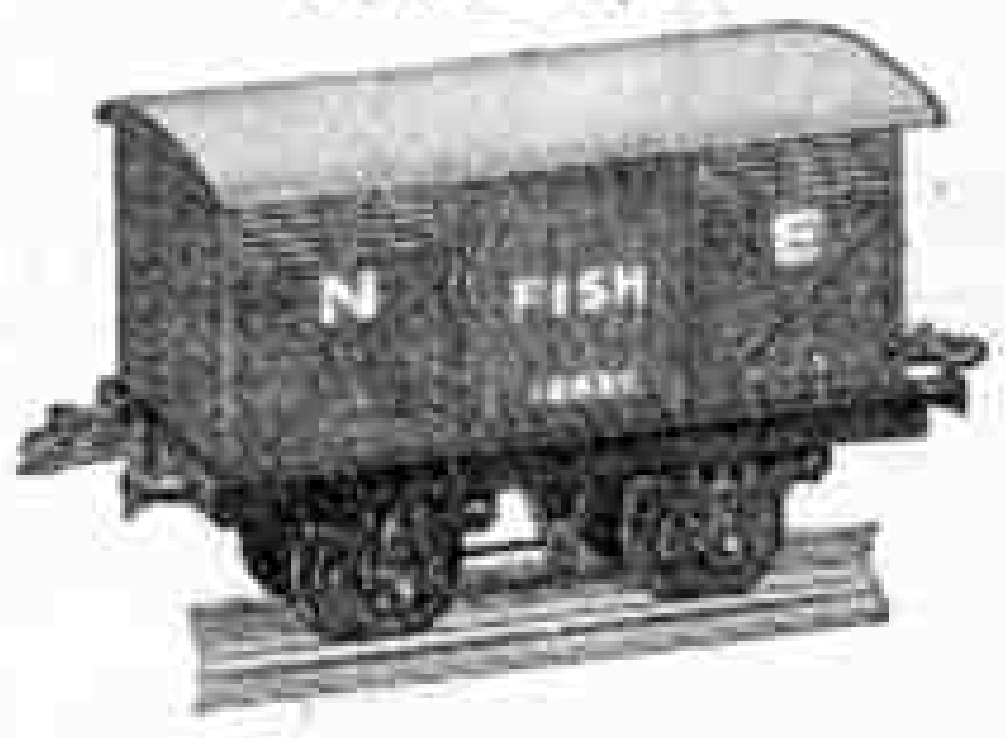
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **2/9**



CRANE TRUCK
Finished in brown and blue. Price **2/11**

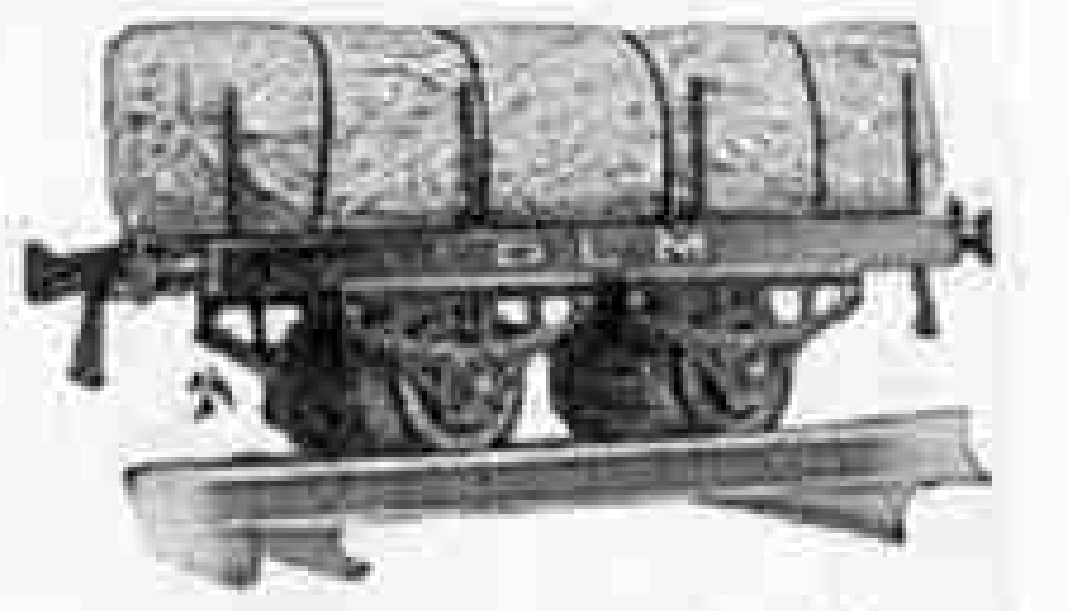


***No. 1 CATTLE TRUCK**
Fitted with sliding doors. Very realistic design. Price **2/9**

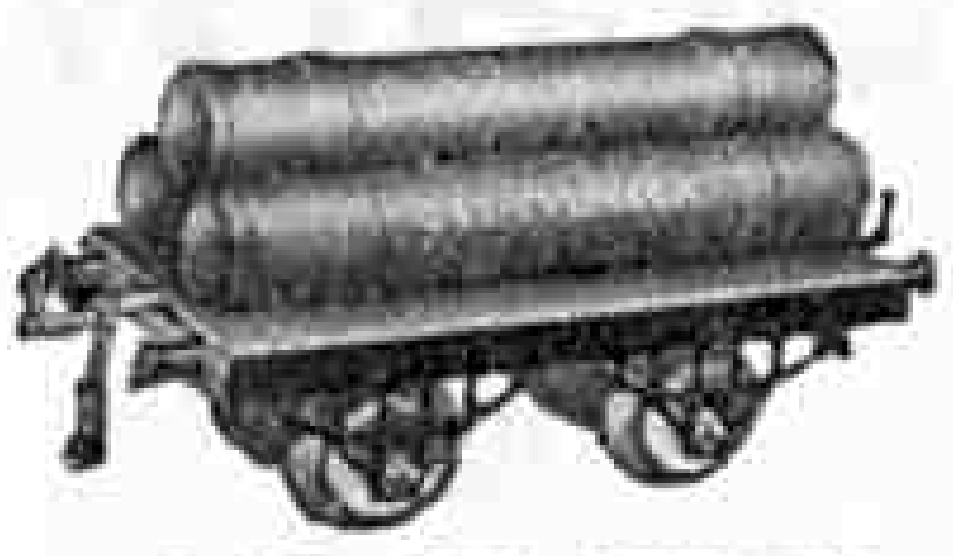


FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **1/9**

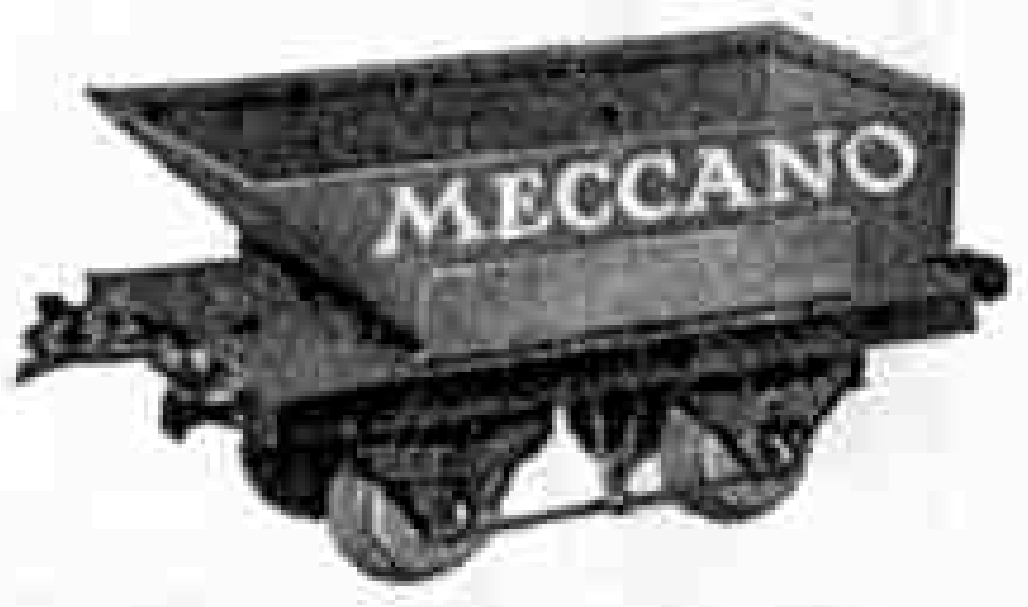
OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/–**



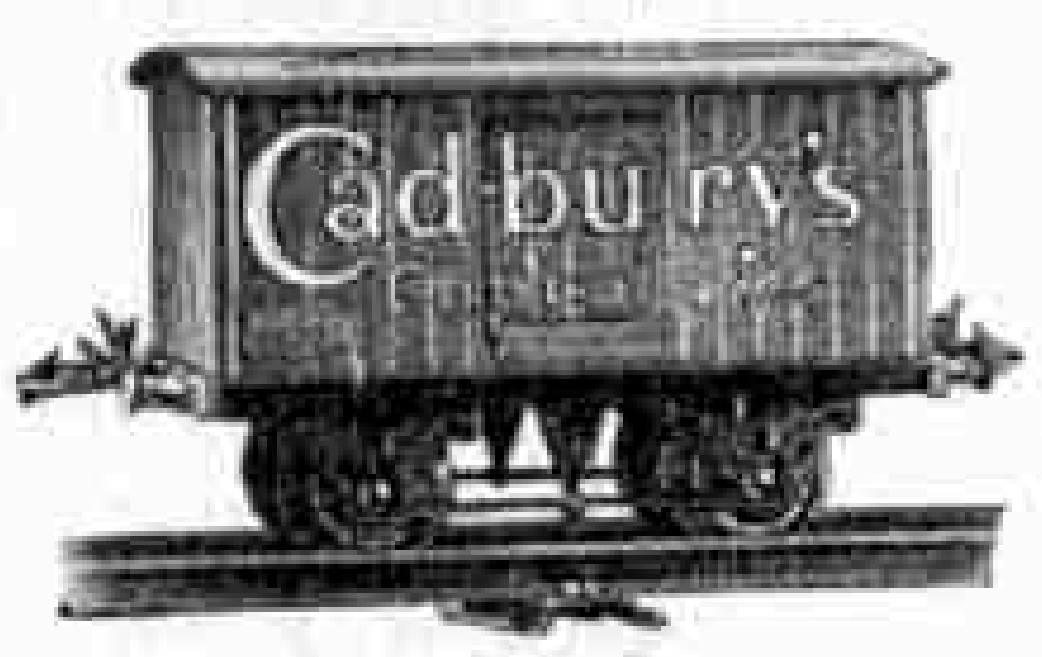
FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/3**



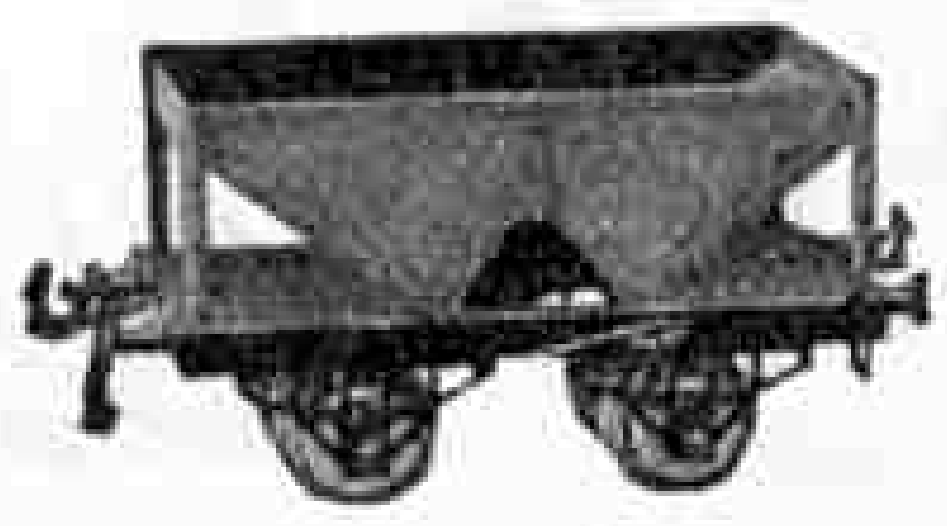
GAS CYLINDER WAGON
Finished in red, lettered gold. Price **1/11**



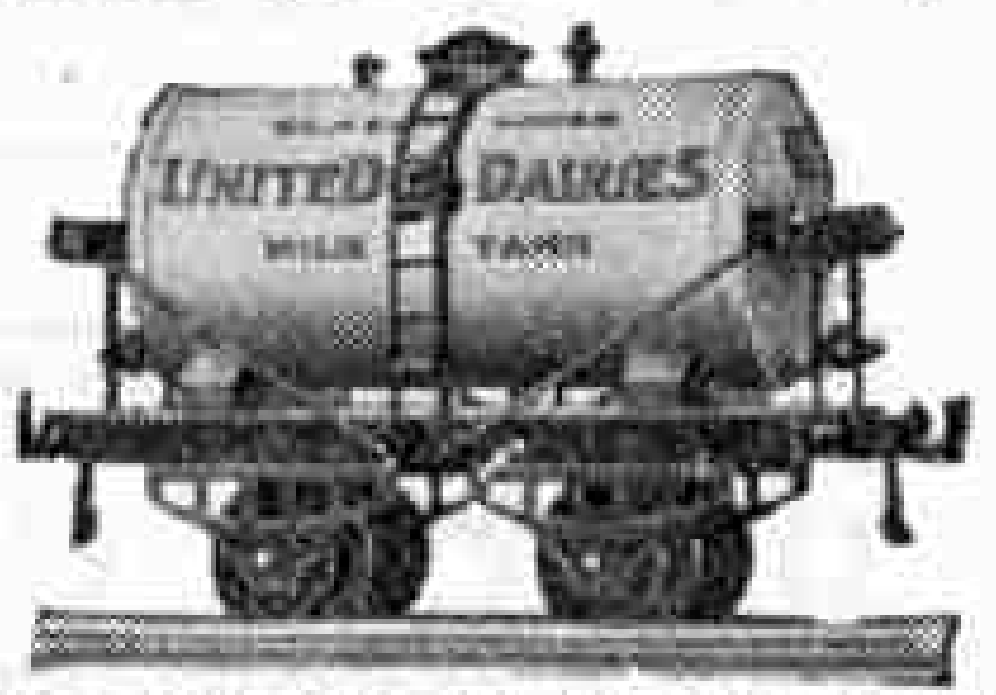
No. I ROTARY TIPPING WAGON
Finished in orange. Price **2/6**



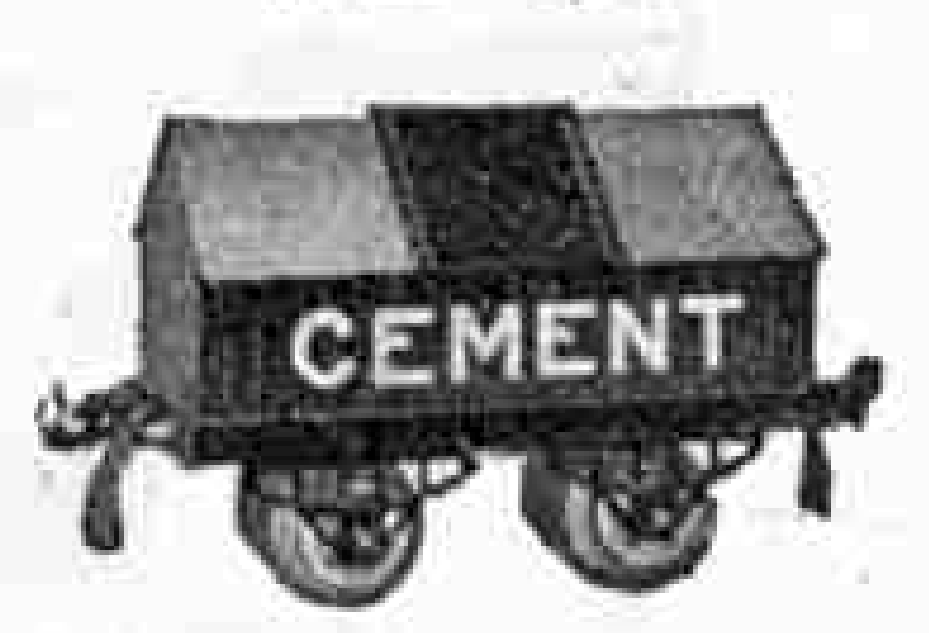
CHOCOLATE VAN "CADBURY'S"
This van is beautifully enamelled in blue with white roof. Price **2/9**



***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**



MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **4/6**



CEMENT WAGON
The door at the top opens. Finished in bright red. Price **2/6**

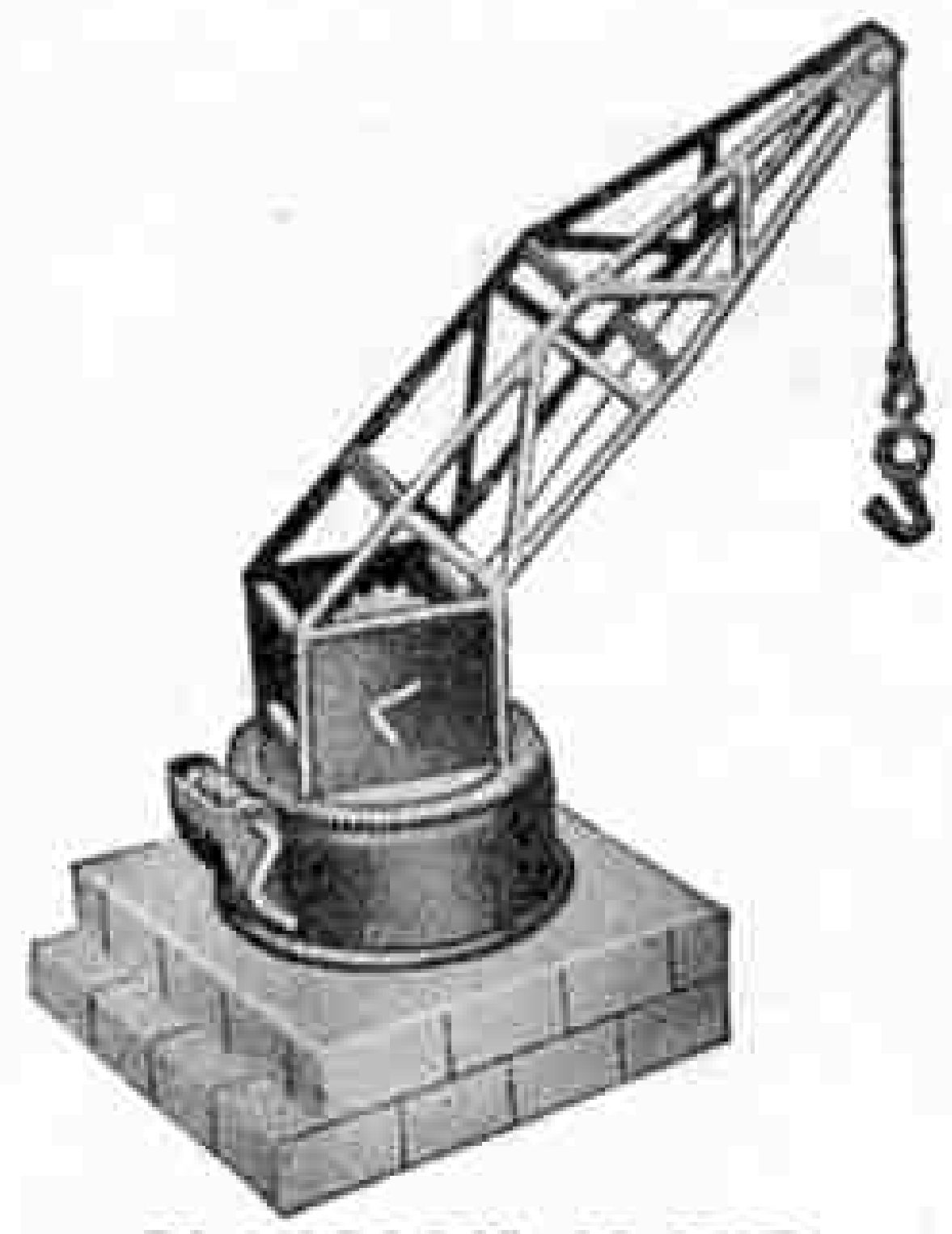
Manufactured by **MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13**

HORNBY SERIES

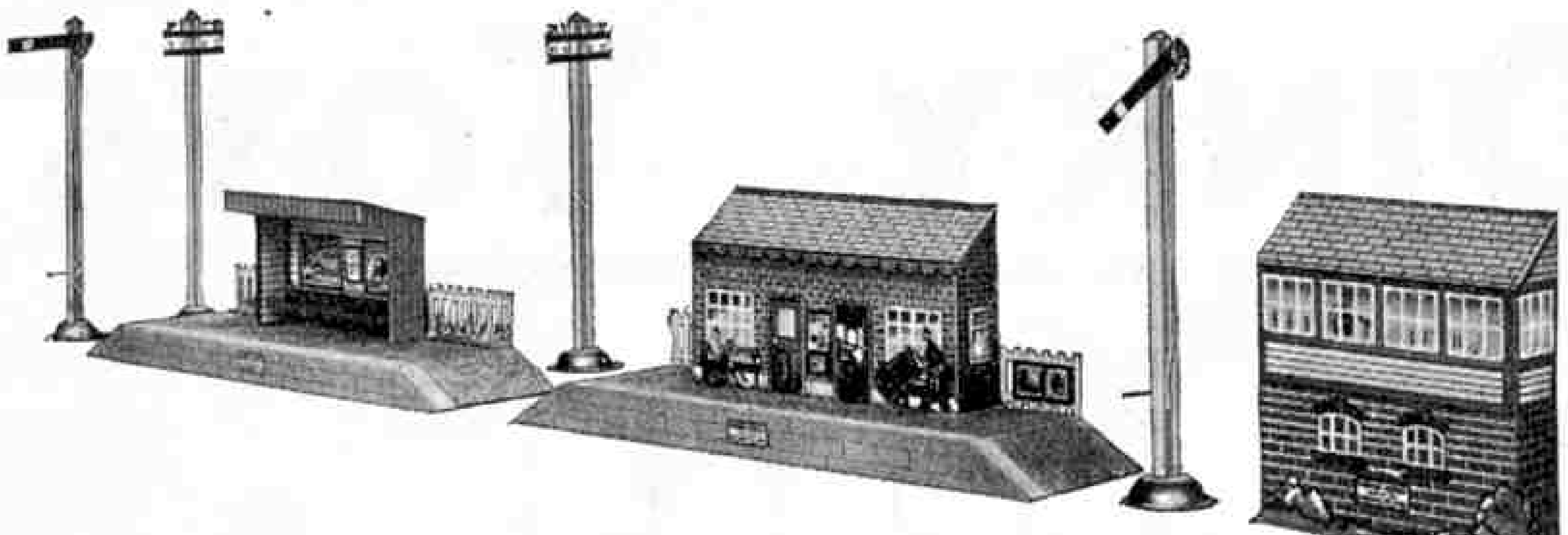
HORNBY ACCESSORIES

GAUGE 0

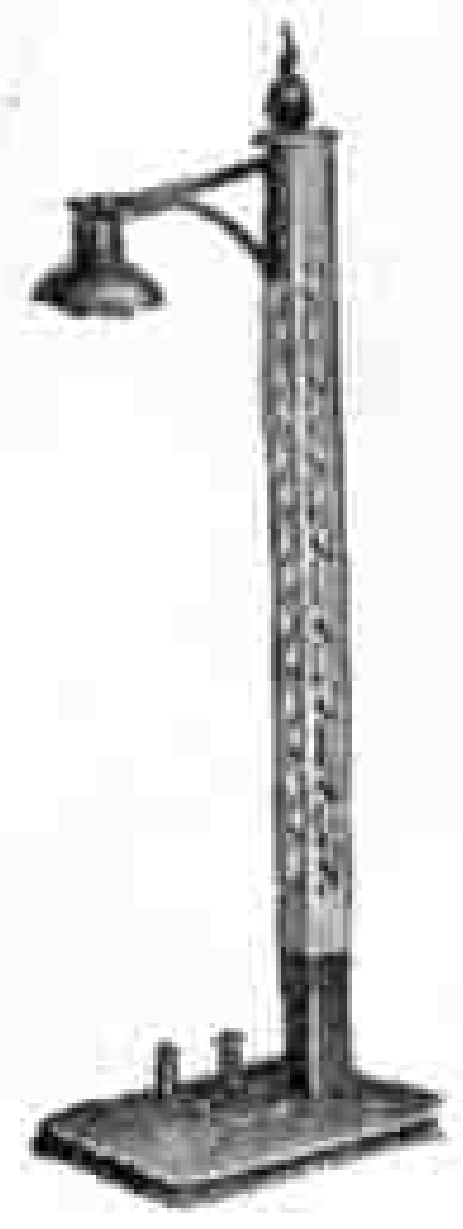
There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway. A selection of Hornby Accessories is shown on this page and also on page xl. Ask your dealer to show you the full range.



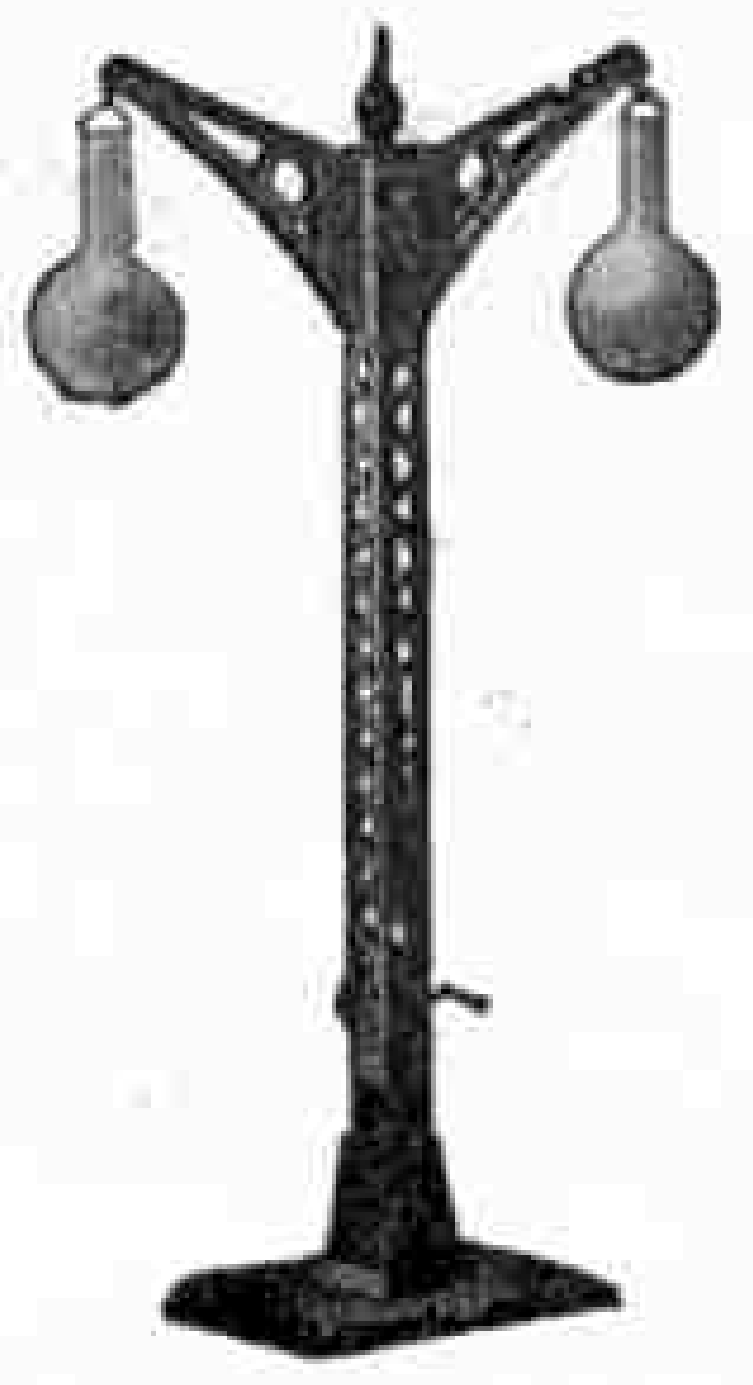
PLATFORM CRANE
Fitted with a crank handle and ratchet mechanism.
Price **3/11**



M STATION SET (7 pieces). Price **3/-** complete
The components of the M Station Set may be purchased separately.
M Signal Box. Price **4**d. M Signal. Price **4**d. M Station. Price **1**/-. M Telegraph Pole No. 1. Price **3**d. M Wayside Station. Price **9**d.



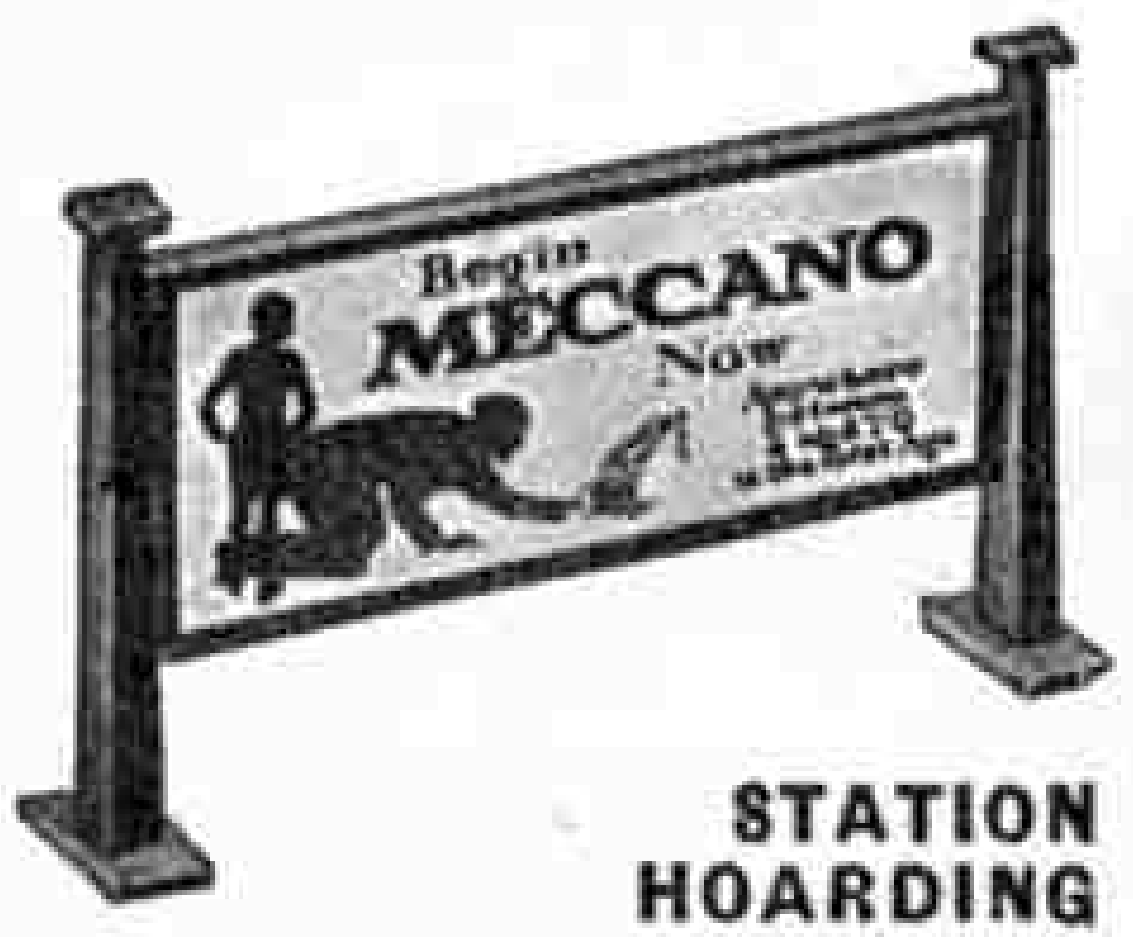
No. 1E LAMP STANDARD ELECTRICAL
(Single, as illustrated.)
Price **2/11**



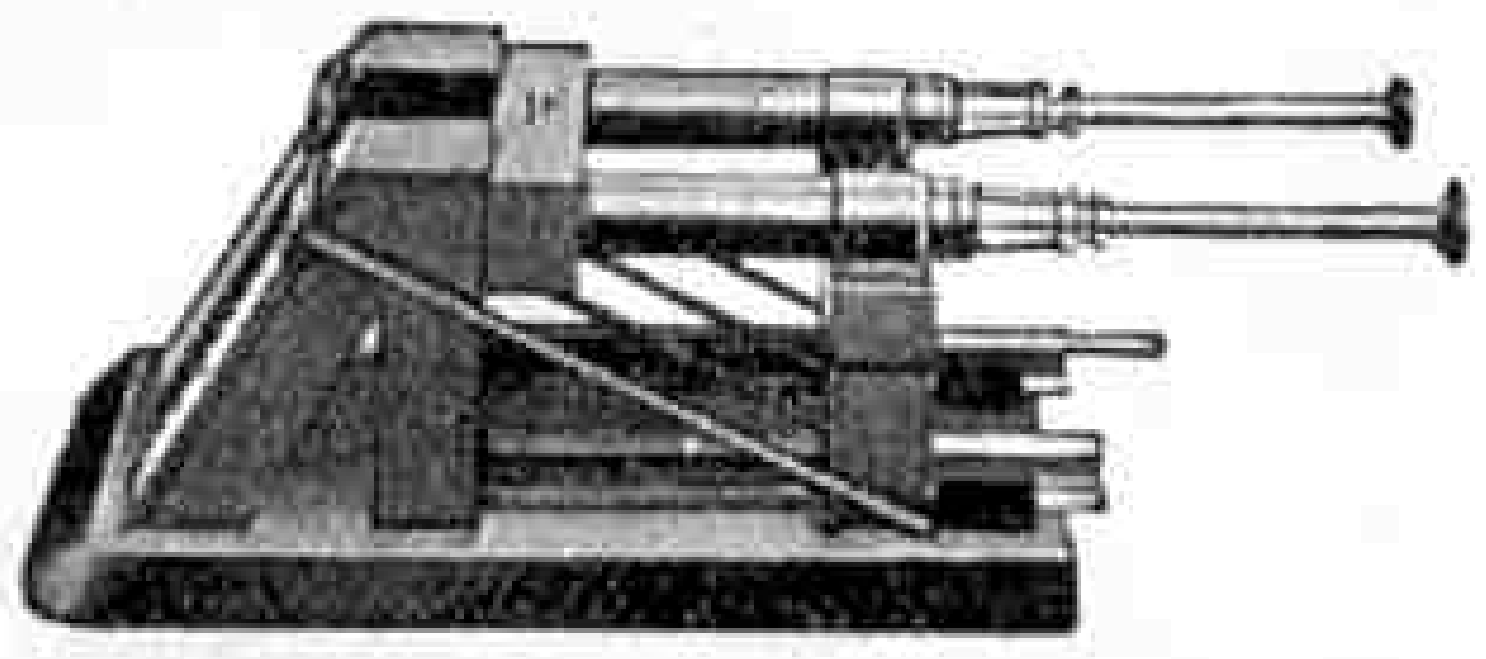
No. 1 LAMP STANDARD
(Single.)
Price **3/3**

No. 2E LAMP STANDARD ELECTRICAL
(Double.)
Price **3/3**

No. 2 LAMP STANDARD
(Double, as illustrated.)
Price **3/9**



STATION HOARDING
This is a realistic accessory, suitable for the station platform. Brightly coloured.
Price **6**d.

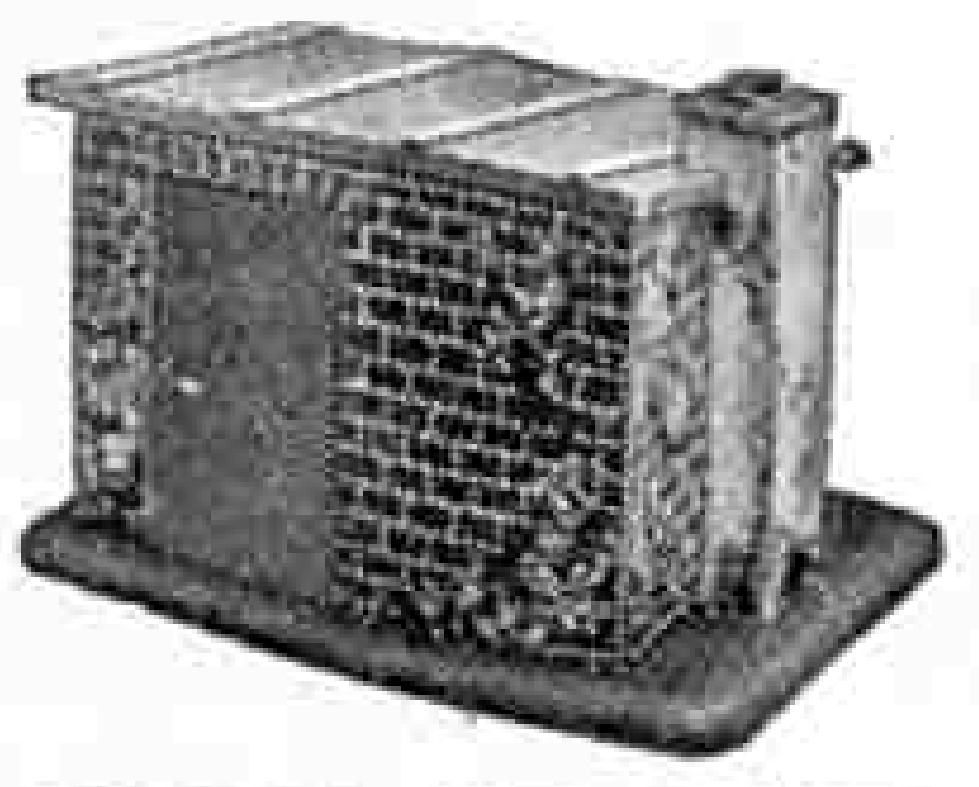


No. 2 BUFFER STOPS
(Hydraulic type.) Price **5/6**

LOADING GAUGE
(Illustrated.)
Price **2/3**
M LOADING GAUGE
Price **1**/-

TUNNEL (Metal)
Price **3/11**

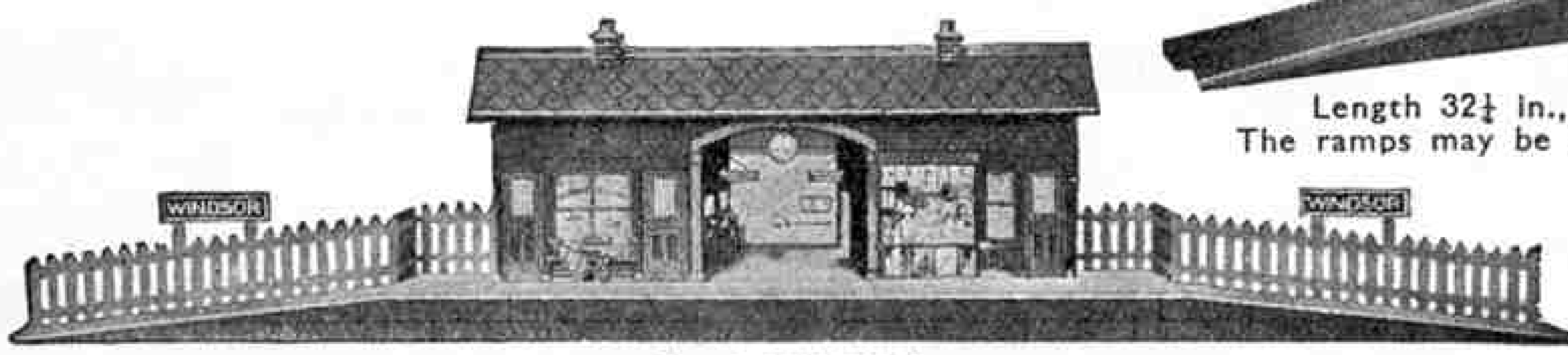
POSTERS IN MINIATURE
These Posters are beautifully printed in full colours.
No. 1 Series. Packet of 51 Price **6**d.
No. 2 Series. Packet of 51 „ **6**d.



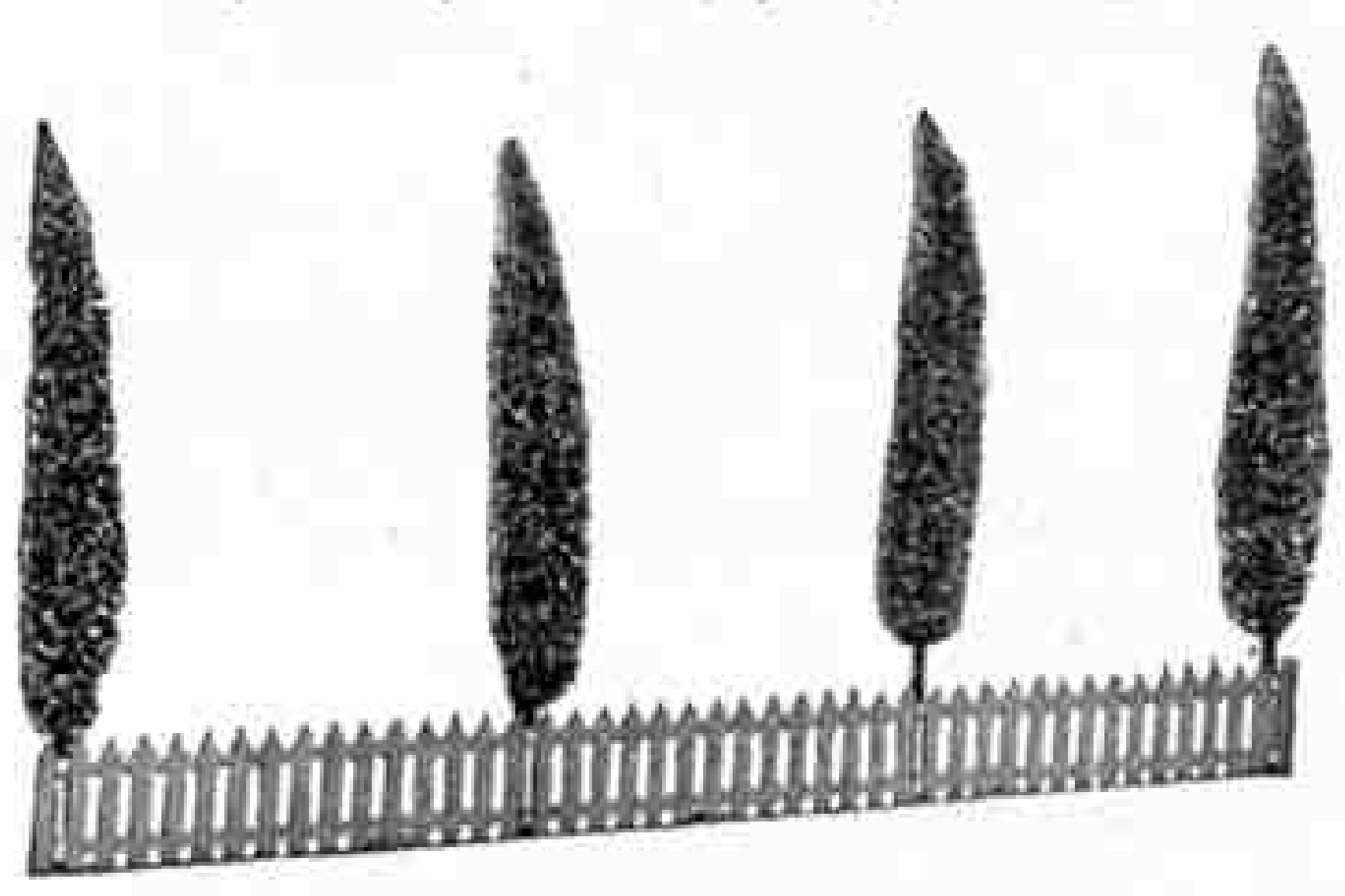
PLATELAYER'S HUT
Price **1**/-

ISLAND PLATFORM
Length 32½ in., height 6⅝ in., width 3 in. Price **5/6**
The ramps may be purchased separately. Price, per pair, **1/9**

No. 7 RAILWAY ACCESSORIES
Watchman's Hut, Brazier, Shovel and Poker. Price **10**d.



No. 2 STATION
Excellent model, beautifully designed. Built up in three detachable sections.
Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **8**/-



FENCING WITH FOUR TREES
Length 16½ in. The miniature trees are detachable. Price, per pair, **2/6**

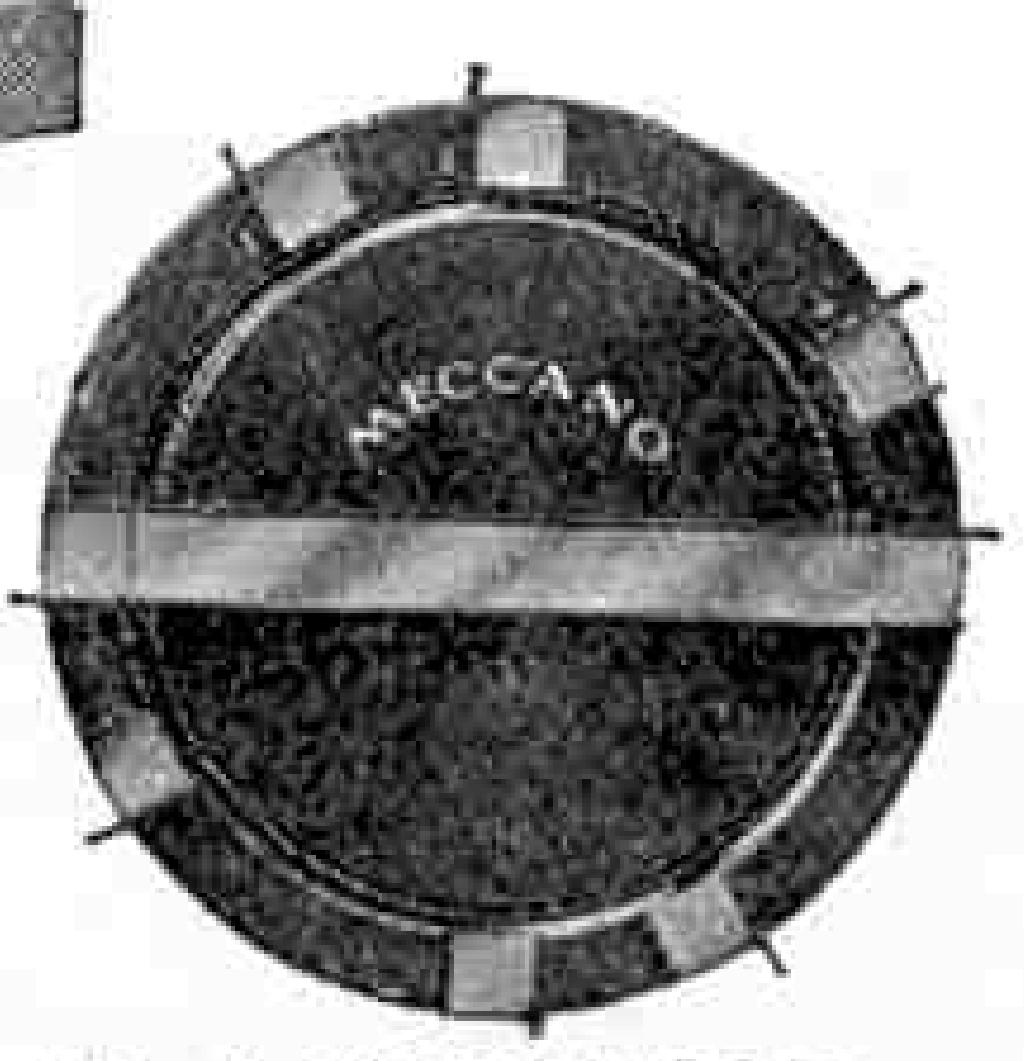
TREES

Trees with Stands, assorted	per doz.	**3/-**
Trees, Oak ...	„	**2/6**
Trees, Poplar ...	„	**2/-**
Stands for Trees	„	**1/-**
Hedging on Base (10½ in. lengths)		**3/-**

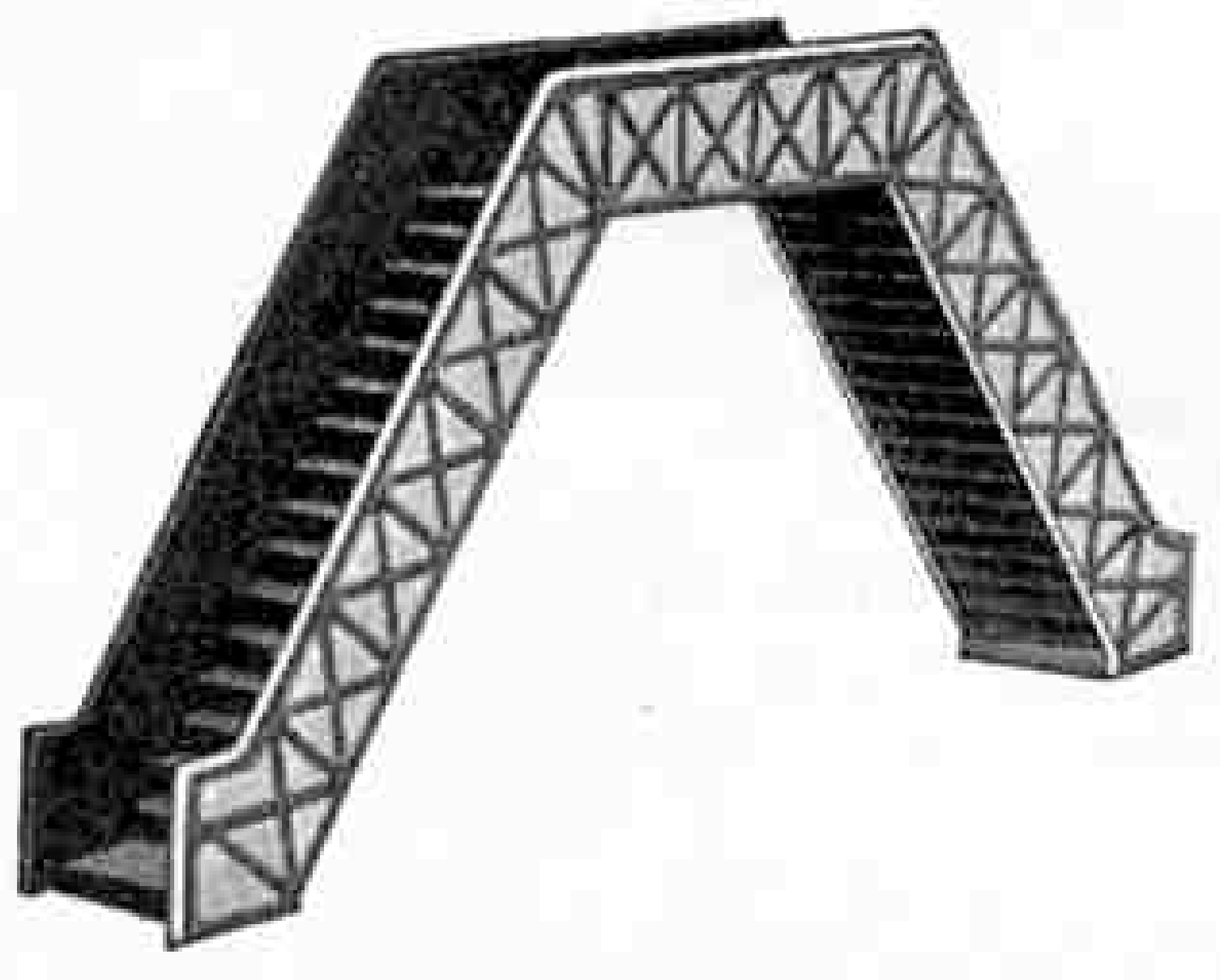
PASSENGER PLATFORM
Length 16⅝ in., width 3 in. This Platform may be connected to the main Station or used separately ... ... Price **2/-**
The white Paled Fencing may be purchased separately. Price per length **6**d.

LUBRICATING OIL
Specially prepared for Hornby Trains, Rolling Stock and Accessories.
Price, per bottle, **6**d.

GRAPHITE GREASE
An ideal lubricant for the springs of Hornby Locomotives and Hornby Speed Boats, Meccano and Aero Clockwork Motors, and Meccano Motor Cars.
Price, per tube, **6**d.

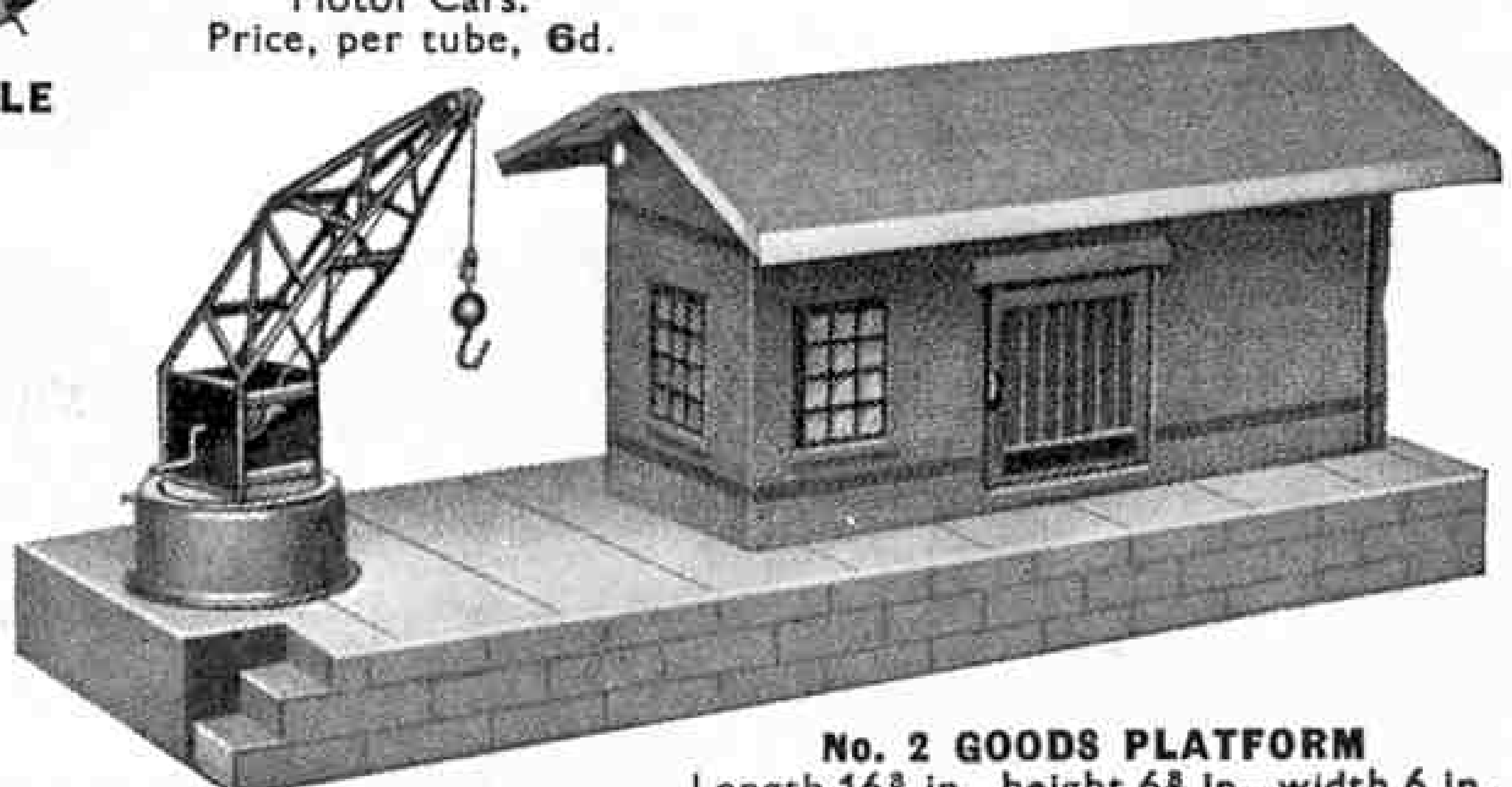


No. 2 TURNTABLE
Price **3/9**



M SERIES FOOTBRIDGE
This strongly-built Footbridge is made to span a single track. Price **1/3**

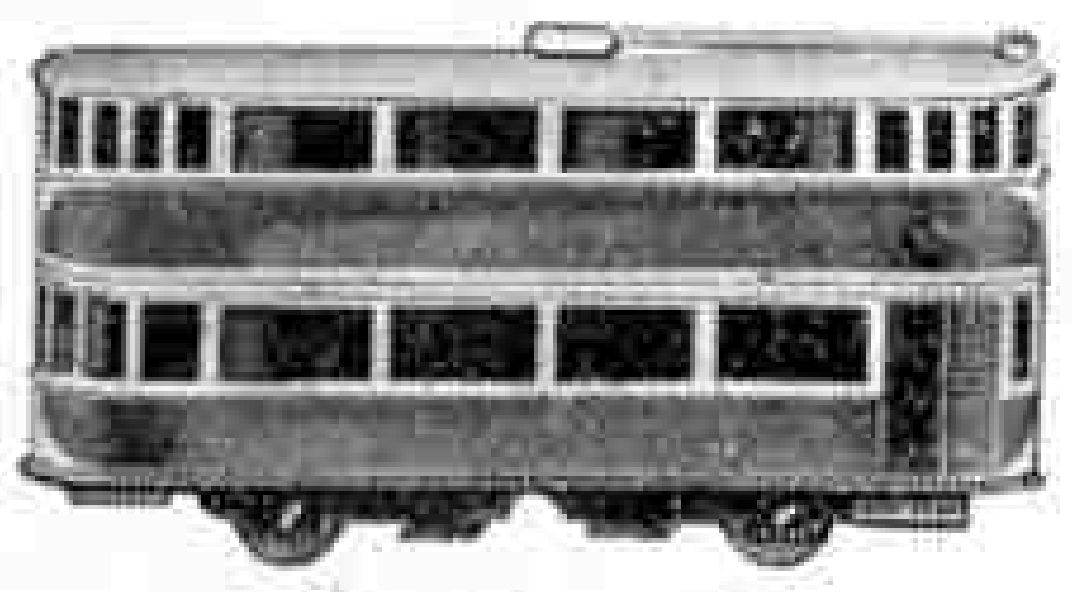
No. 1 GOODS PLATFORM
Length 13 in., height 6⅝ in., width 6 in. Price **7/6**



No. 2 GOODS PLATFORM
Length 16⅝ in., height 6⅝ in., width 6 in.
The crane at the end of the platform revolves on its base. Price **10/6**

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

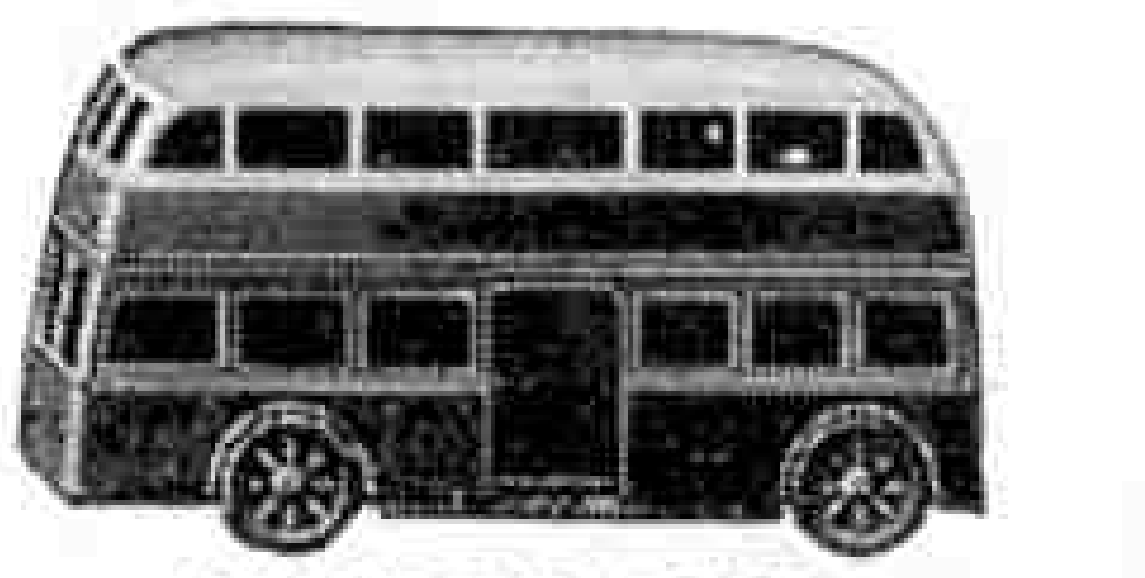
TOYS OF QUALITY MADE BY MECCANO LTD



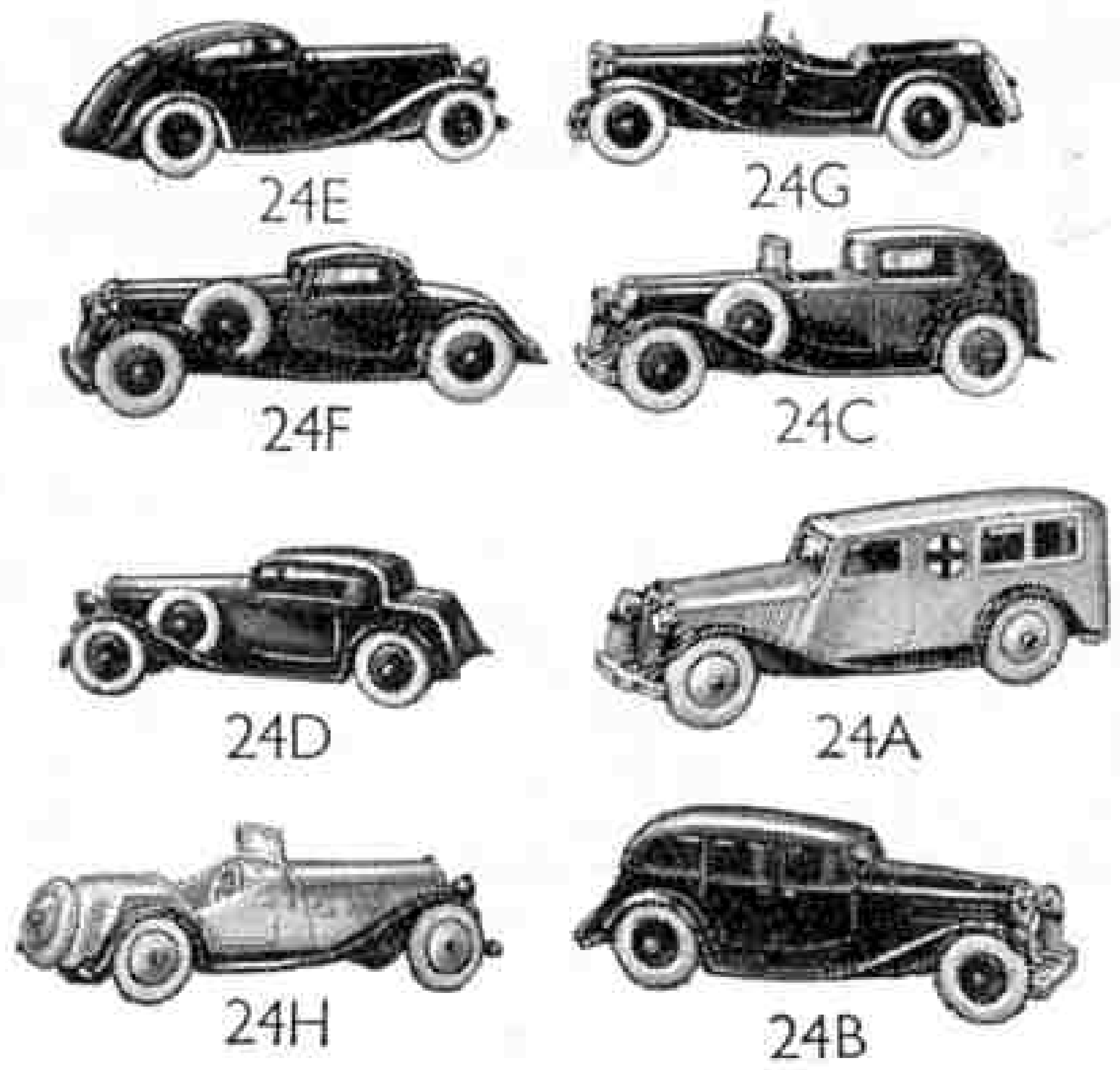
TRAM CAR
Dinky Toys No. 27
Assorted colours. Price 3d. each

DINKY 200 VARIETIES TOYS

A FASCINATING COLLECTING HOBBY



MOTOR BUS
Dinky Toys No. 29
Assorted colours. Price 4d. each

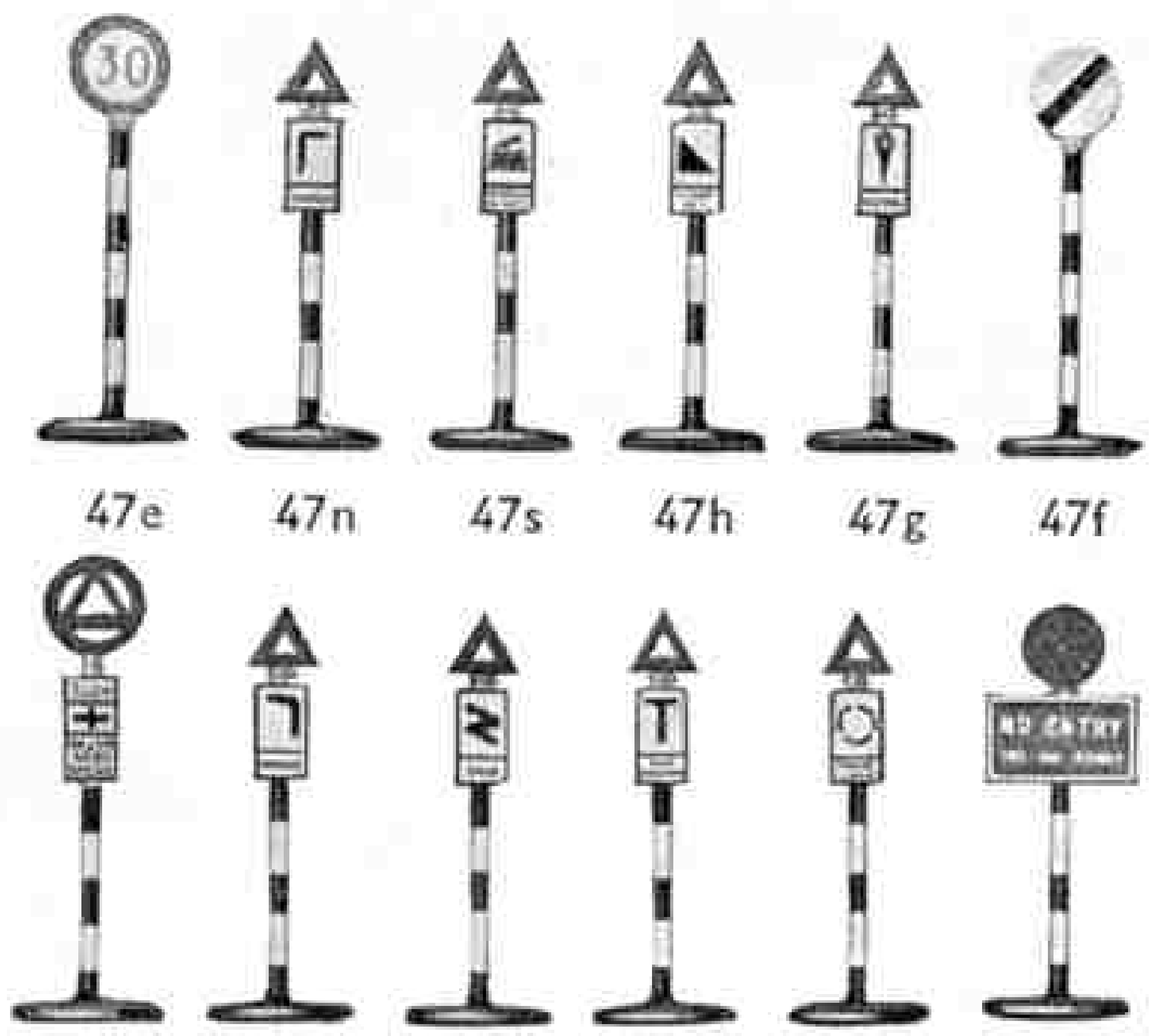


MOTOR CARS

Dinky Toys No. 24
Fitted with detachable rubber tyres and silver-plated radiators

No.	Item	Price
No. 24a	Ambulance	each 9d.
No. 24b	Limousine	,, 9d.
No. 24c	Town Sedan	,, 9d.
No. 24d	Vogue Saloon	,, 9d.
No. 24e	Super Streamline Saloon	,, 9d.
No. 24f	Sportsman's Coupé	,, 9d.
No. 24g	Sports Tourer (4 seater)	,, 9d.
No. 24h	Sports Tourer (2 seater)	,, 9d.

Price of complete set 6/-

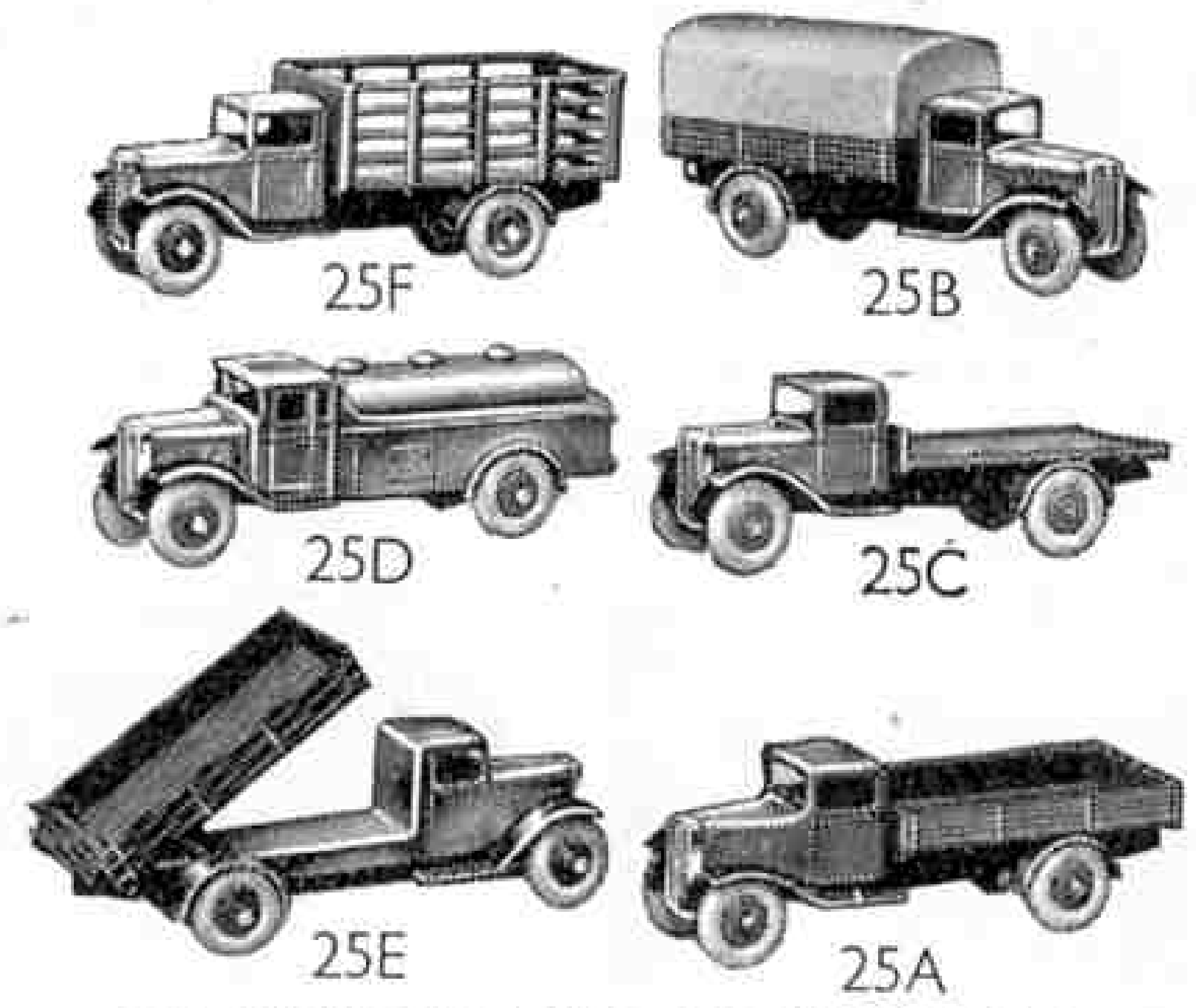


ROAD SIGNS

Dinky Toys No. 47

No.	Item	Price
No. 47e	"30 Mile Limit" Sign	2 for 3d.
No. 47f	"De-restriction" Sign	,, 3d.
No. 47g	"School" Sign	,, 3d.
No. 47h	"Steep Hill" Sign	,, 3d.
No. 47k	"Bend" Sign	,, 3d.
No. 47m	Left-hand "Corner" Sign	,, 3d.
No. 47n	Right-hand "Corner" Sign	,, 3d.
No. 47p	"Road Junction" Sign	,, 3d.
No. 47q	"No Entry" Sign	,, 3d.
No. 47r	"Major Road Ahead" Sign	,, 3d.
No. 47s	"Crossing, No Gates" Sign	,, 3d.
No. 47t	"Round-About" Sign	,, 3d.

Price of complete set of twelve 1/6

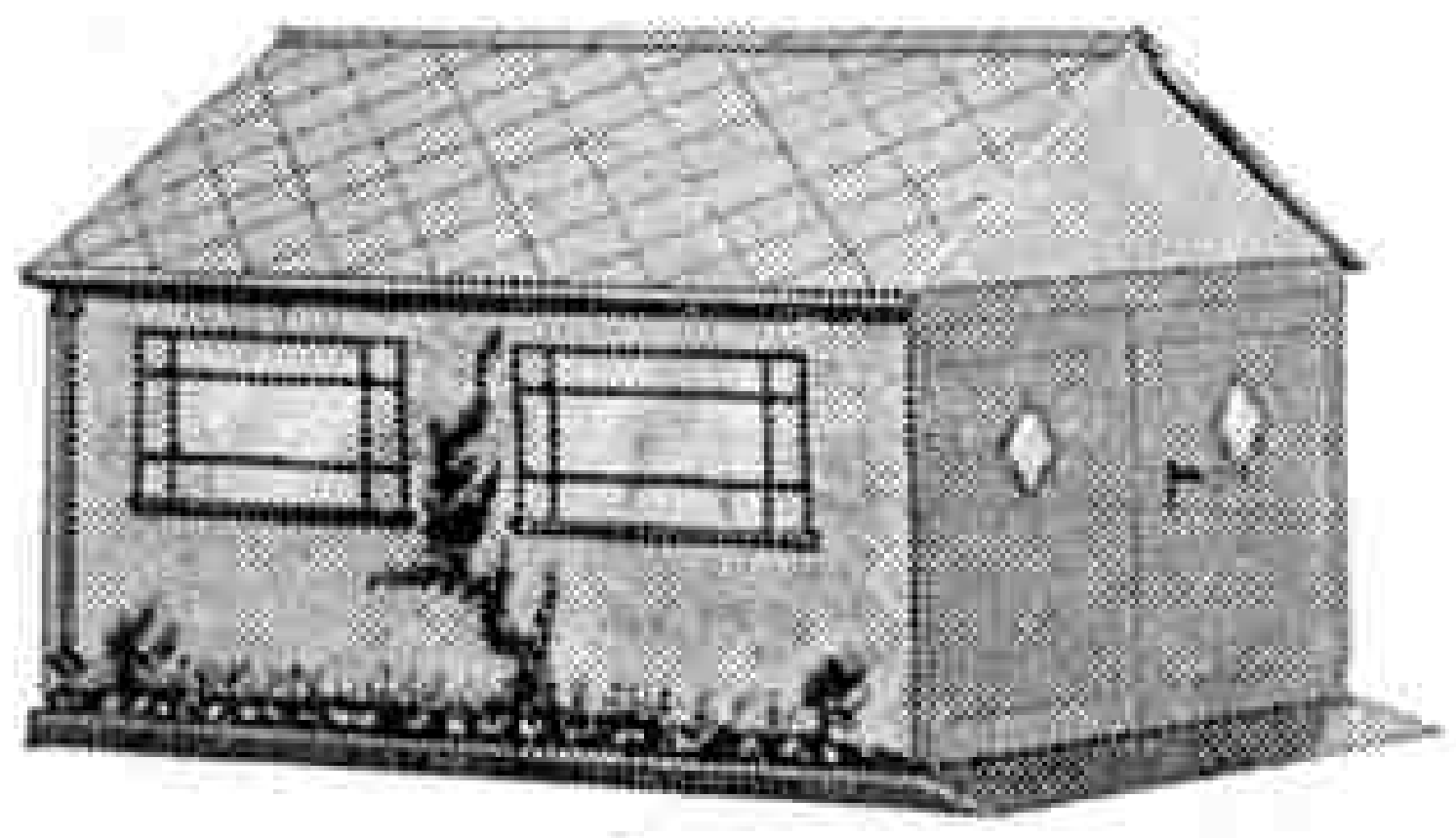


COMMERCIAL MOTOR VEHICLES

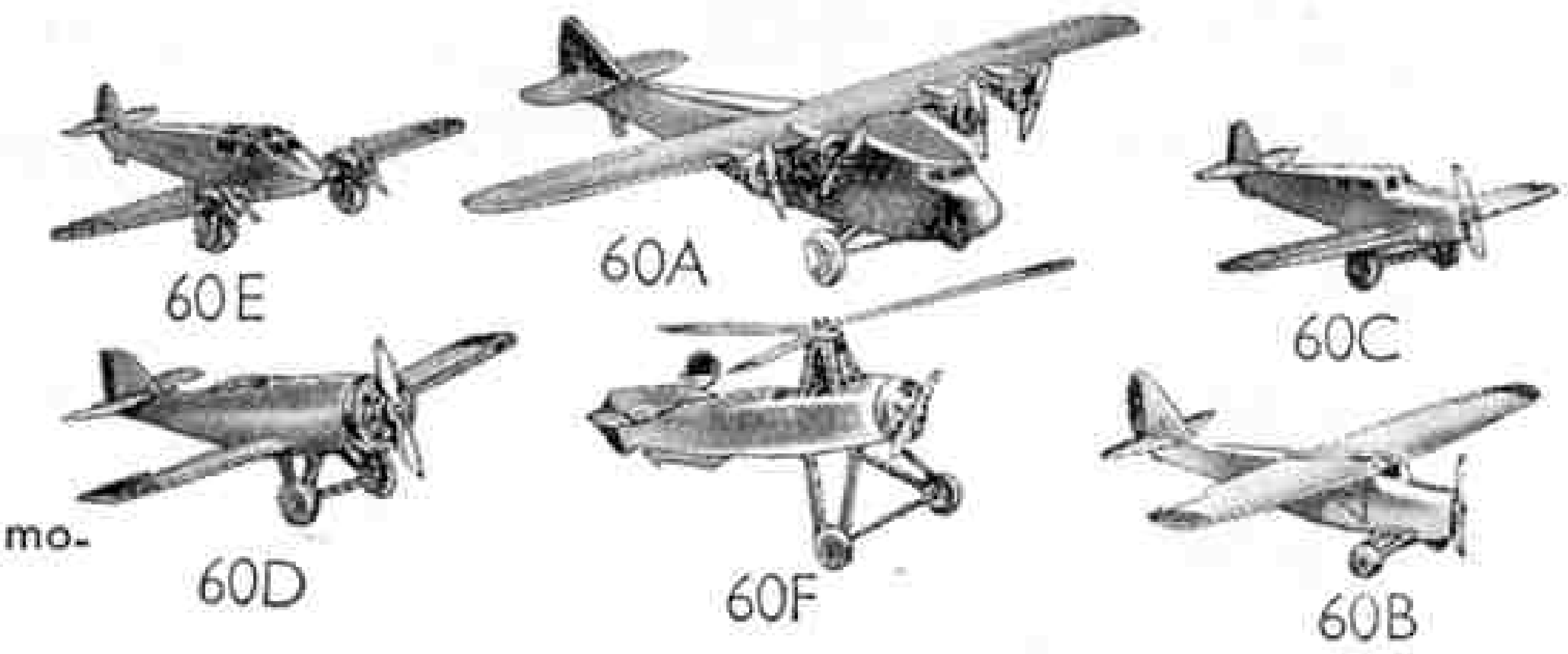
Dinky Toys No. 25
Fitted with detachable rubber tyres and silver-plated radiators

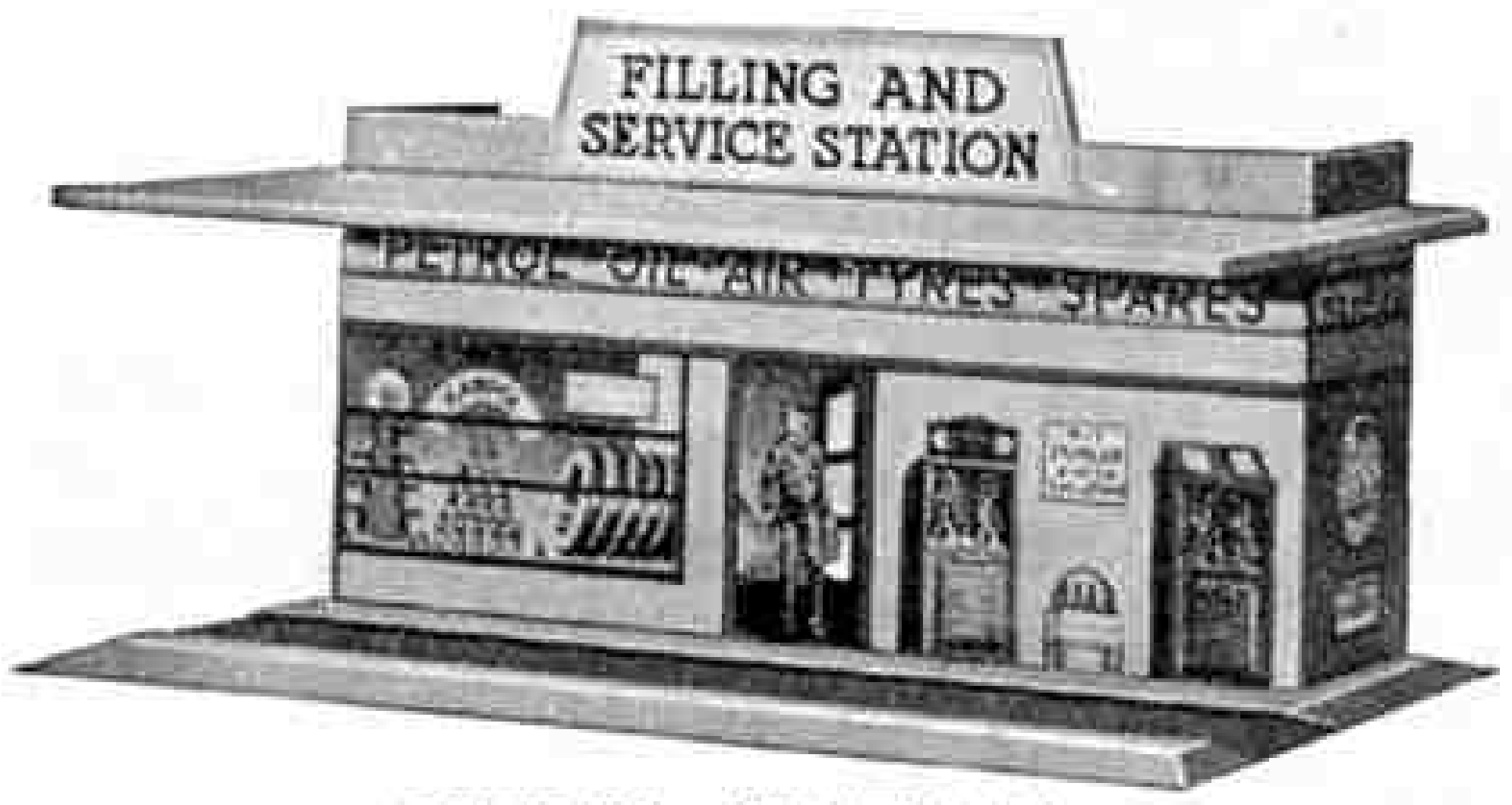
No.	Item	Price
No. 25a	Wagon	each 9d.
No. 25b	Covered Van	,, 9d.
No. 25c	Flat Truck	,, 9d.
No. 25d	Petrol Tank Wagon	,, 9d.
No. 25e	Tipping Wagon	,, 9d.
No. 25f	Market Gardener's Van	,, 9d.

Price of complete set 4/6



GARAGE
Dinky Toys No. 45
Fitted with opening double doors. Will accommodate any two Dinky Toy Motor Cars.
Price 1/6 each





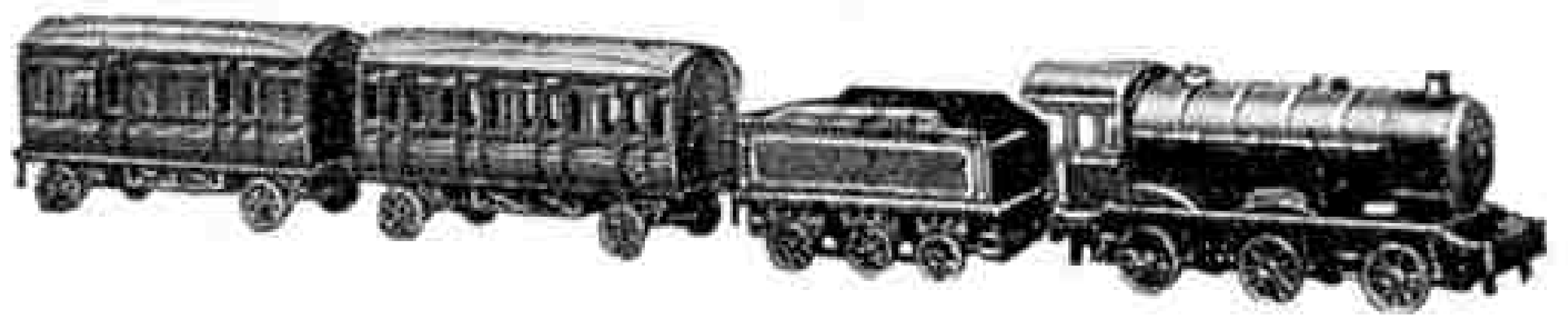
PETROL STATION
Dinky Toys No. 48
Accurate reproduction of a filling station. Tastefully printed in appropriate colours.
Price 1/6 each

AEROPLANES

Dinky Toys No. 60

No.	Item	Price
No. 60a	Imperial Airways Liner	each 9d.
No. 60b	D.H. "Leopard Moth"	,, 6d.
No. 60c	Percival "Gull"	,, 6d.
No. 60d	Low Wing Monoplane	,, 6d.
No. 60e	General "Monospar"	,, 6d.
No. 60f	Cierva "Autogiro"	,, 6d.

Price of complete set 3/-



PASSENGER TRAIN SET

Dinky Toys No. 17

No.	Item	Price
No. 17a	Locomotive	each 9d.
No. 17b	Tender	,, 5d.
No. 20a	Coach	,, 7d.
No. 20b	Guard's Van	,, 7d.

Price of complete set 2/3

MIXED GOODS TRAIN SET

Dinky Toys No. 19

No.	Item	Price
No. 21a	Tank Locomotive	each 9d.
No. 21b	Wagon	,, 4d.
No. 21d	Petrol Tank Wagon	,, 6d.
No. 21e	Lumber Wagon	,, 5d.

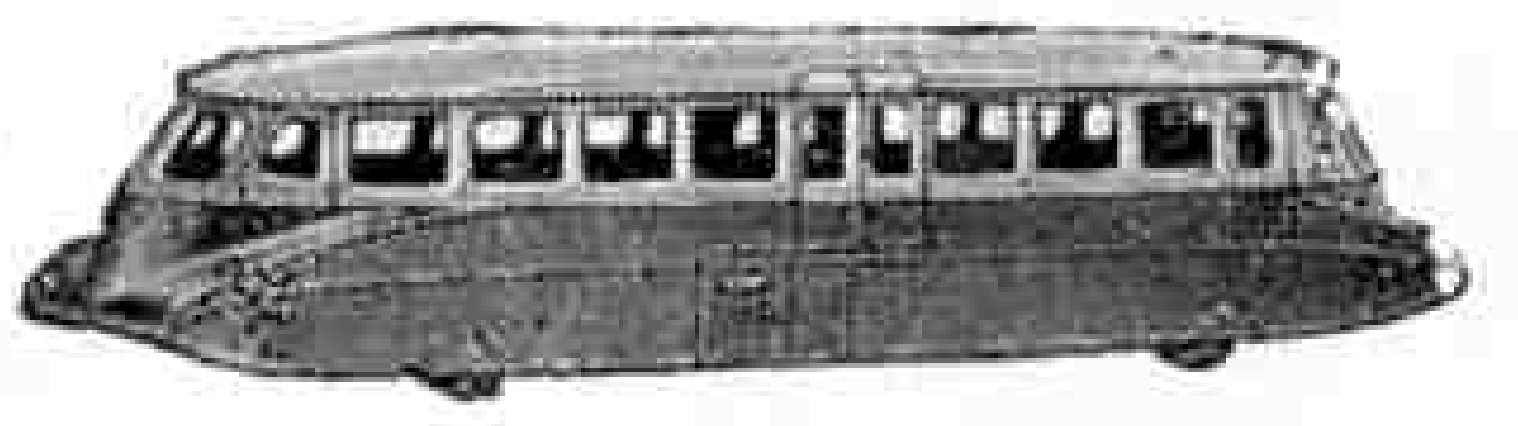
Price of complete set 1/11

GOODS TRAIN SET

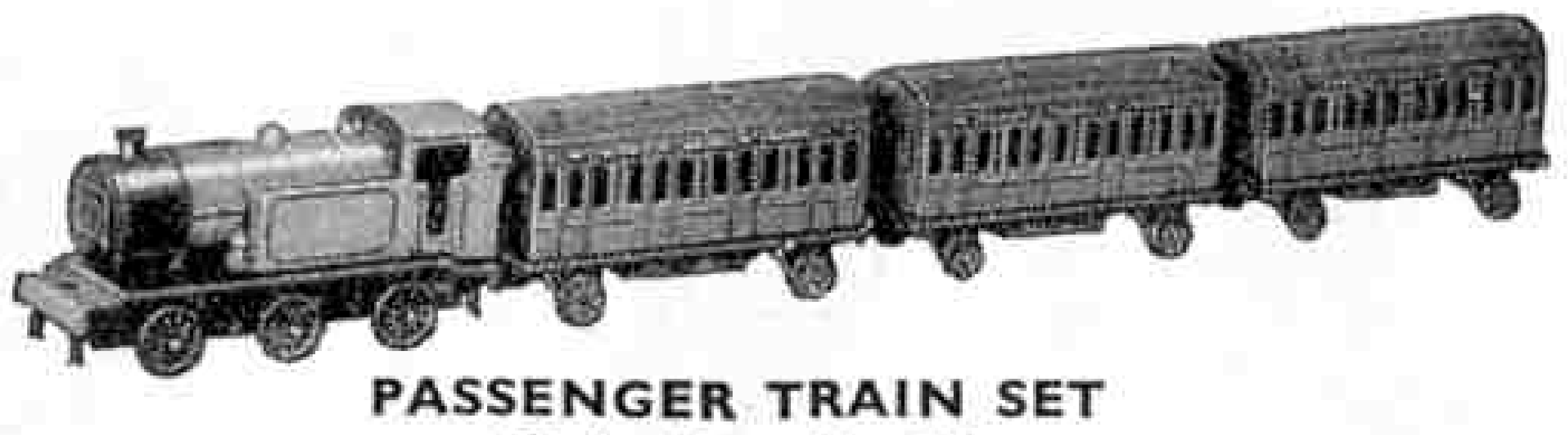
Dinky Toys No. 18

No.	Item	Price
No. 21a	Tank Locomotive	each 9d.
No. 21b	Wagons (3)	,, 4d.

Price of complete set 1/9



G.W.R. RAIL CAR
Dinky Toys No. 26
Assorted colours. Price 4d. each



PASSENGER TRAIN SET

Dinky Toys No. 20

No.	Item	Price
No. 21a	Tank Locomotive	each 9d.
No. 20a	Coaches (2)	,, 7d.
No. 20b	Guard's Van	,, 7d.

Price of complete set 2/6

Ask your dealer for a complete illustrated list of Dinky Toys

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

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DINKY TOYS
200 VARIETIES

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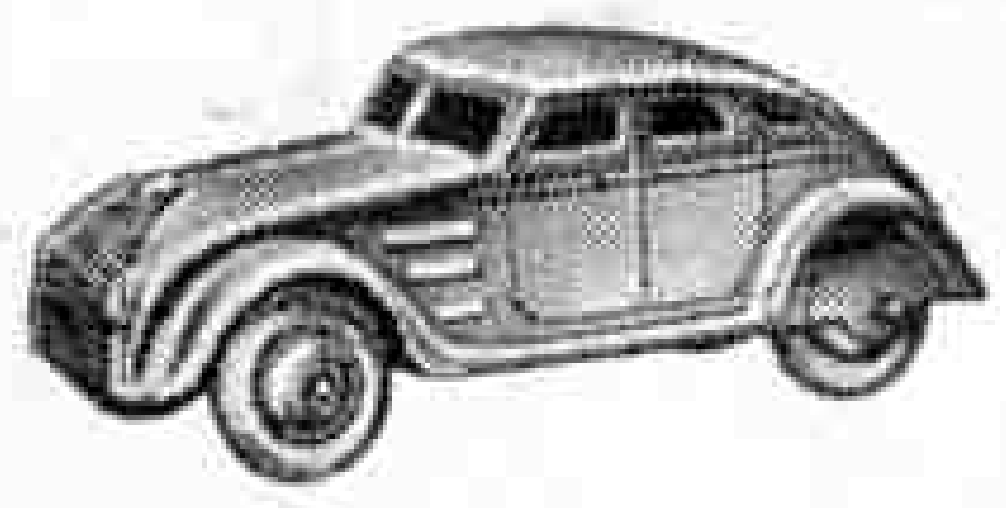
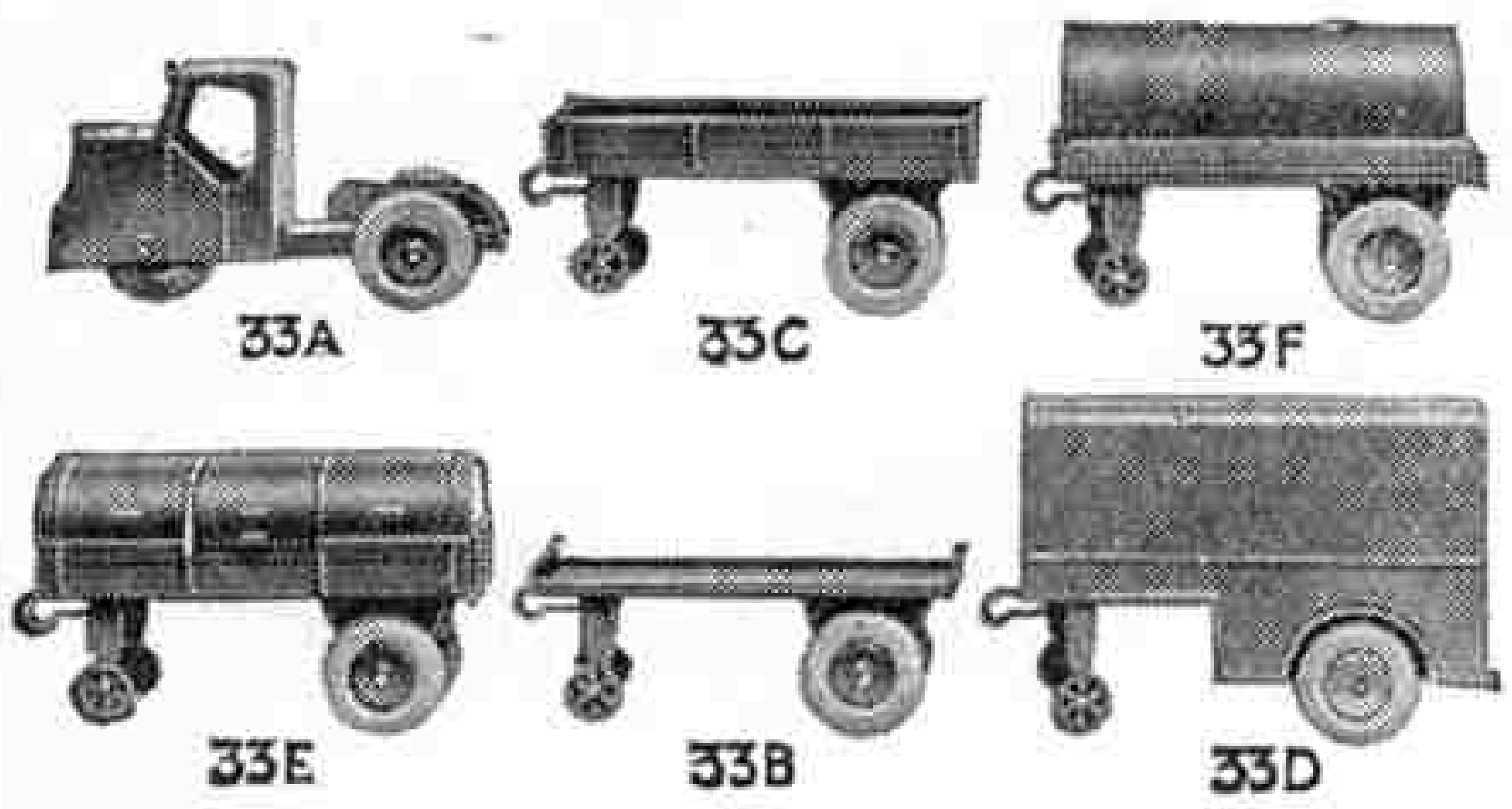
Dinky Toys are the most realistic and the most attractive models in miniature ever produced. They are unique in their perfection of finish, and their range is so wide as to appeal to all tastes. Start now to collect these delightful little models.



STREAMLINE SALOON
Dinky Toys No. 22h
Assorted colours. Fitted with rubber tyres.
Price 6d. each

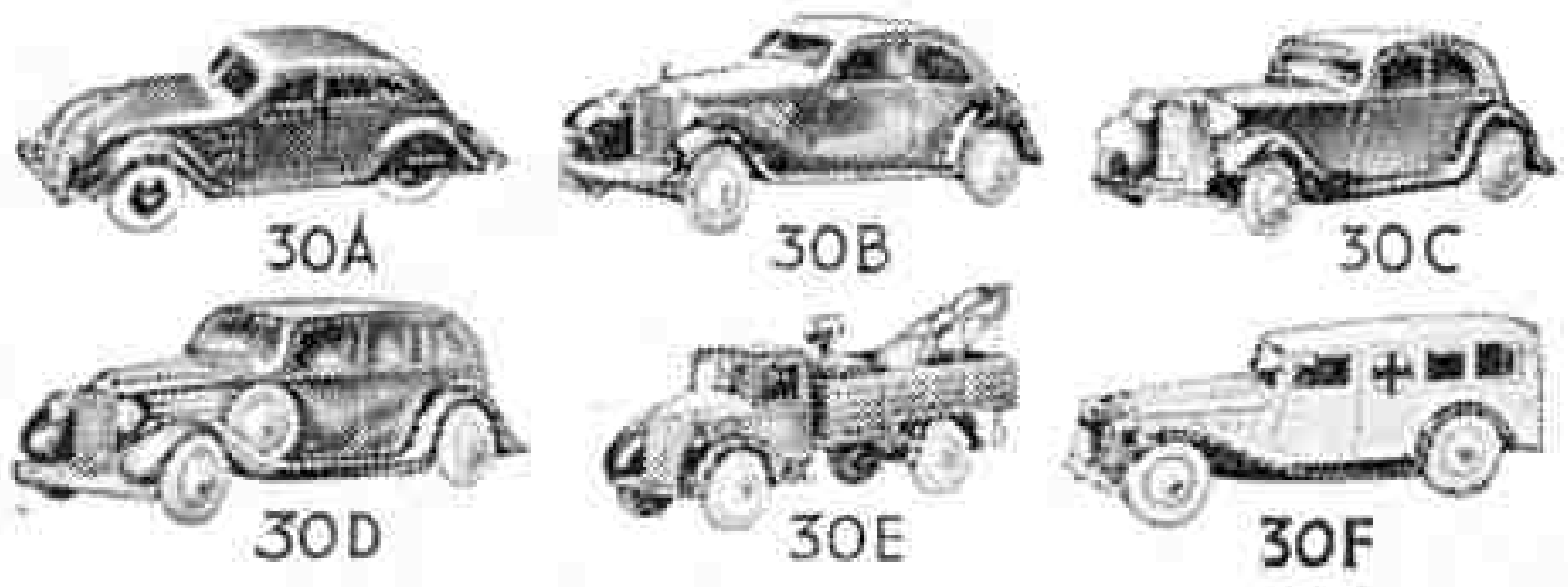
ROYAL AIR MAIL SERVICE CAR
Dinky Toys No. 34
In correct colours. Fitted with rubber tyres.
Price 6d. each



MECHANICAL HORSE AND FIVE ASSORTED TRAILERS
Dinky Toys No. 33
Fitted with rubber tyres

No. 33a	Mechanical Horse ...	each 6d.
No. 33b	Flat Truck	„ 6d.
No. 33c	Open Wagon	„ 6d.
No. 33d	Box Van	„ 8d.
No. 33e	Dust Wagon	„ 8d.
No. 33f	Petrol Tank	„ 8d.

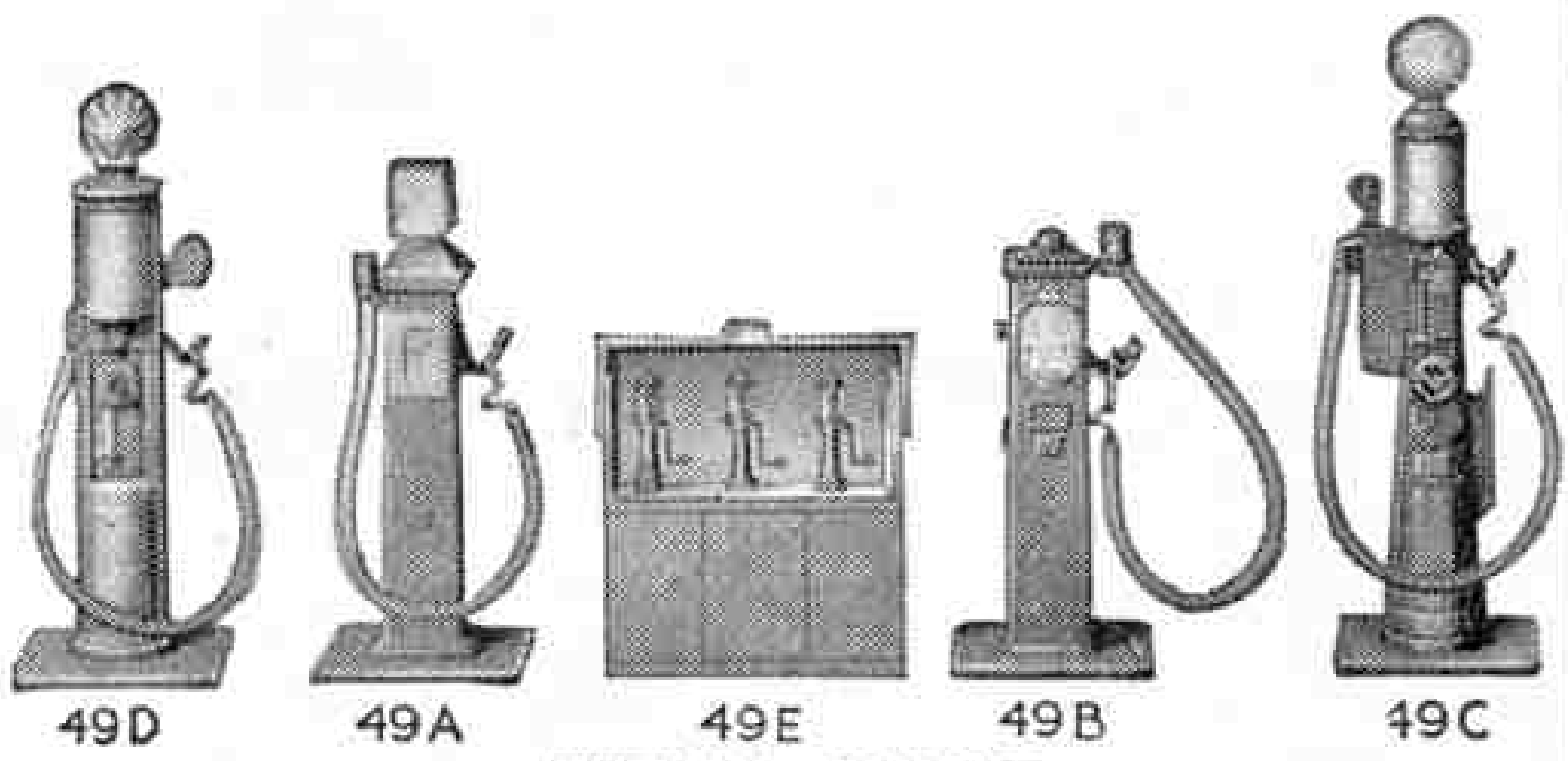
Price of complete set 3/6



MOTOR VEHICLES
Dinky Toys No. 30
Fitted with rubber tyres and silver-plated radiators.

No. 30a	Chrysler Airflow Saloon ...	each 9d.
No. 30b	Rolls-Royce Car	„ 9d.
No. 30c	Daimler Car...	„ 9d.
No. 30d	Vauxhall Car	„ 9d.
No. 30e	Breakdown Car	„ 9d.
No. 30f	Ambulance	„ 9d.

Price of complete set 4/6



PETROL PUMPS
Dinky Toys No. 49
Scale models fitted with rubber hose pipes. Finished in correct colours.

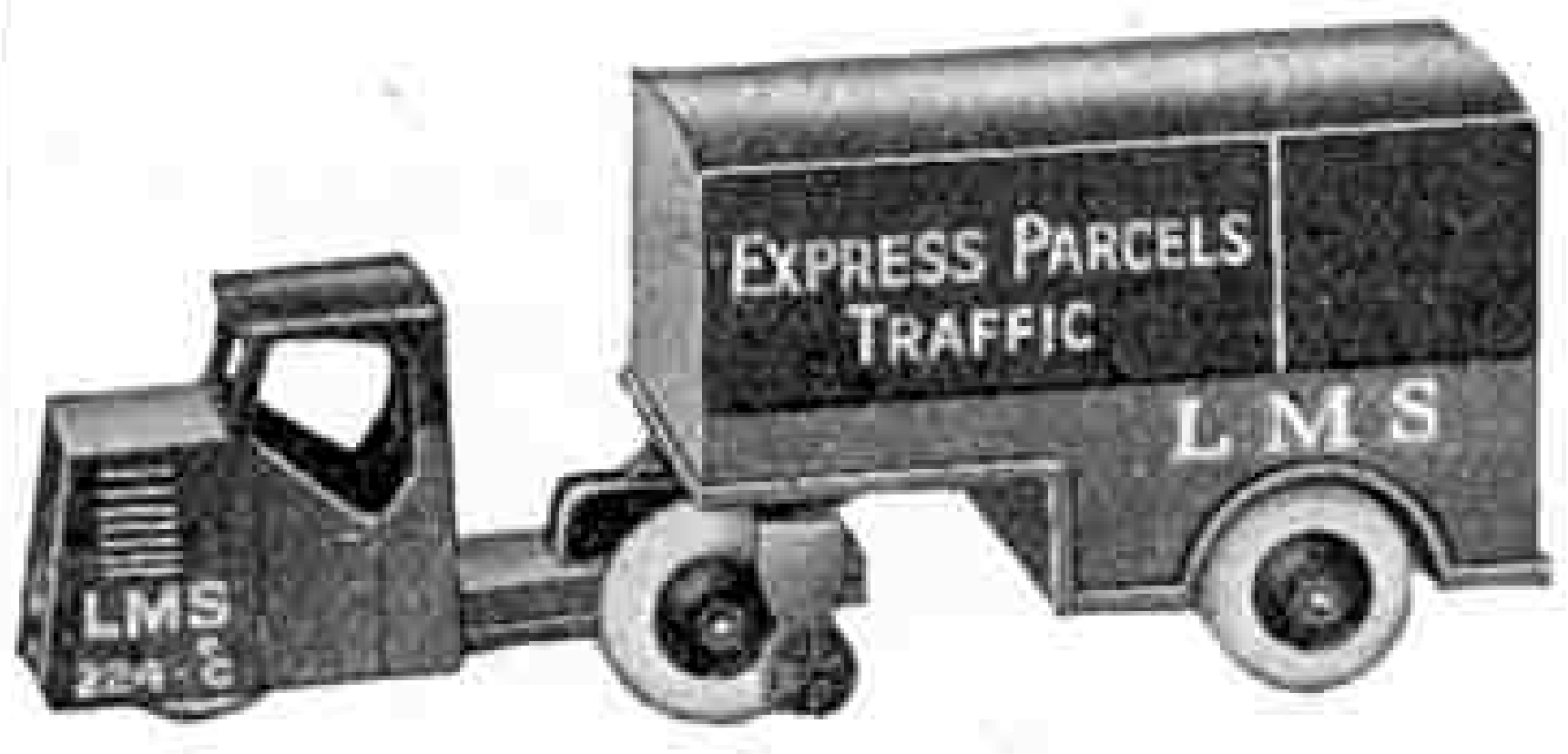
No. 49a	Bowser Pump	... each 4d.
No. 49b	Wayne Pump	... „ 4d.
No. 49c	Theo Pump	... „ 4d.
No. 49d	Shell Pump	... „ 4d.
No. 49e	Oil Bin (Pratts)	... „ 3d.

Price of complete set 1/6

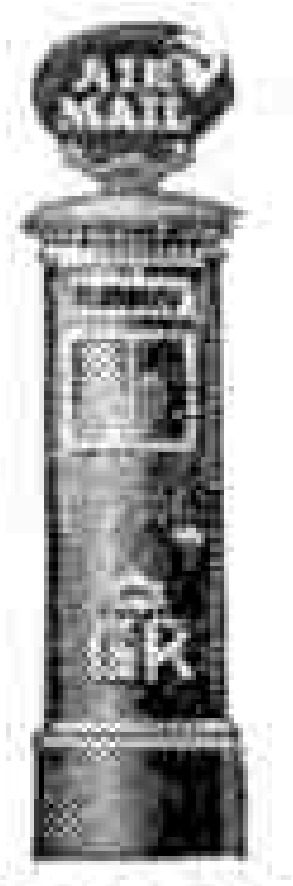
DELIVERY VANS
Dinky Toys No. 28/1

No. 28a	Hornby Train Van ...	... each 6d.
No. 28b	Seccotine Van	„ 6d.
No. 28c	Manchester Guardian Van	„ 6d.
No. 28e	Firestone Tyres Van ...	„ 6d.
No. 28f	Palethorpe's Sausage Van ...	„ 6d.
No. 28n	Atco Lawn Mowers Van ...	„ 6d.

Price of complete set 3/-



RAILWAY MECHANICAL HORSE AND TRAILER VAN
Dinky Toys No. 33R
Price complete, L.M.S.R., L.N.E.R., G.W.R. or S.R., 1/6

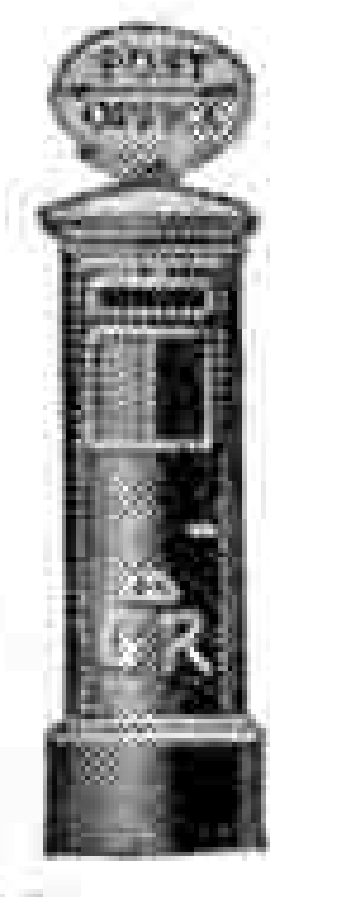


PILLAR LETTER BOX AIR MAIL
Dinky Toys No. 12b
Price 3d. each

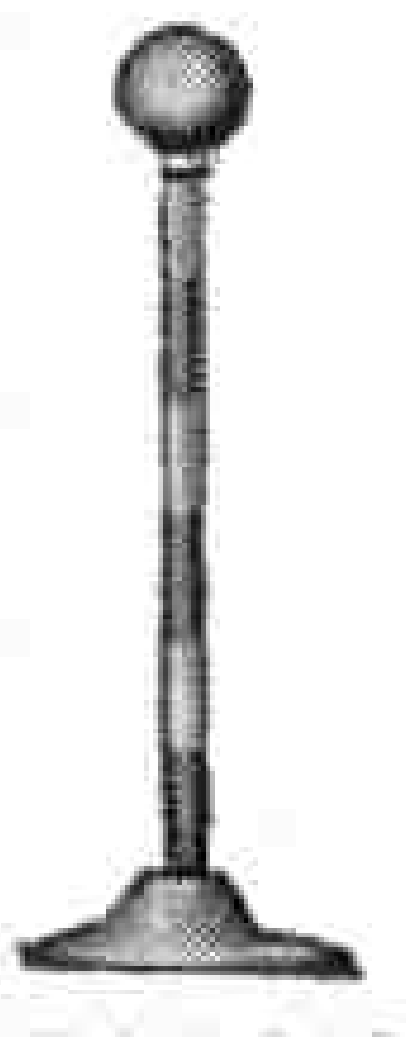
DELIVERY VANS
Dinky Toys No. 28/2

No. 28d	Oxo Van	... each 6d.
No. 28g	Kodak Cameras Van ...	„ 6d.
No. 28h	Dunlop Tyres Van ...	„ 6d.
No. 28k	Marsh and Baxter's Sausage Van... ...	„ 6d.
No. 28m	Wakefield's Castrol Oil Van	„ 6d.
No. 28p	Crawford's Biscuit Van	„ 6d.

Price of complete set 3/-



PILLAR LETTER BOX G.P.O.
Dinky Toys No. 12a
Price 3d. each

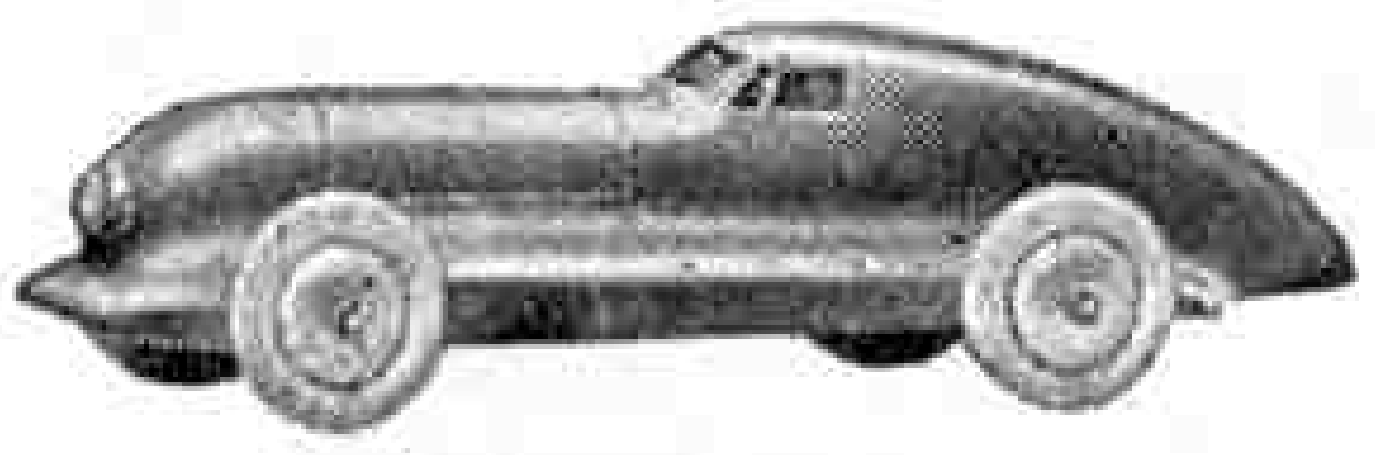


BEACON
Dinky Toys No. 47d
(Realistic models of the Belisha Safety Beacons).
Price 1d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47a
(Four-face)
Price 3d. each

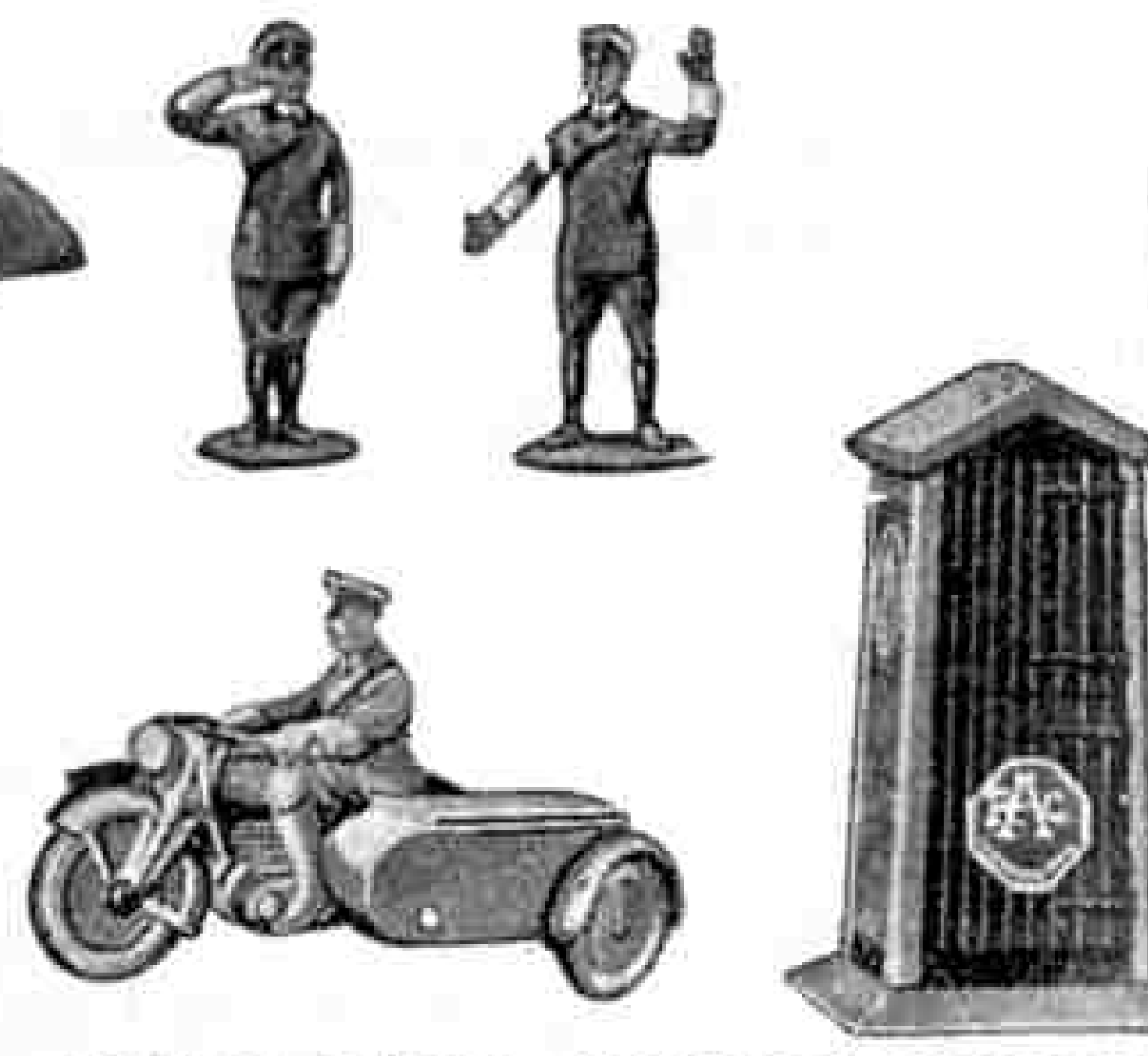
ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47b
(Three-face)
Price 3d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47c
(Two-face)
Right-angle or Back-to-back.
Price 3d. each



HOTCHKISS RACING CAR
Dinky Toys No. 23b
Assorted colours. Fitted with rubber tyres.
Price 6d. each

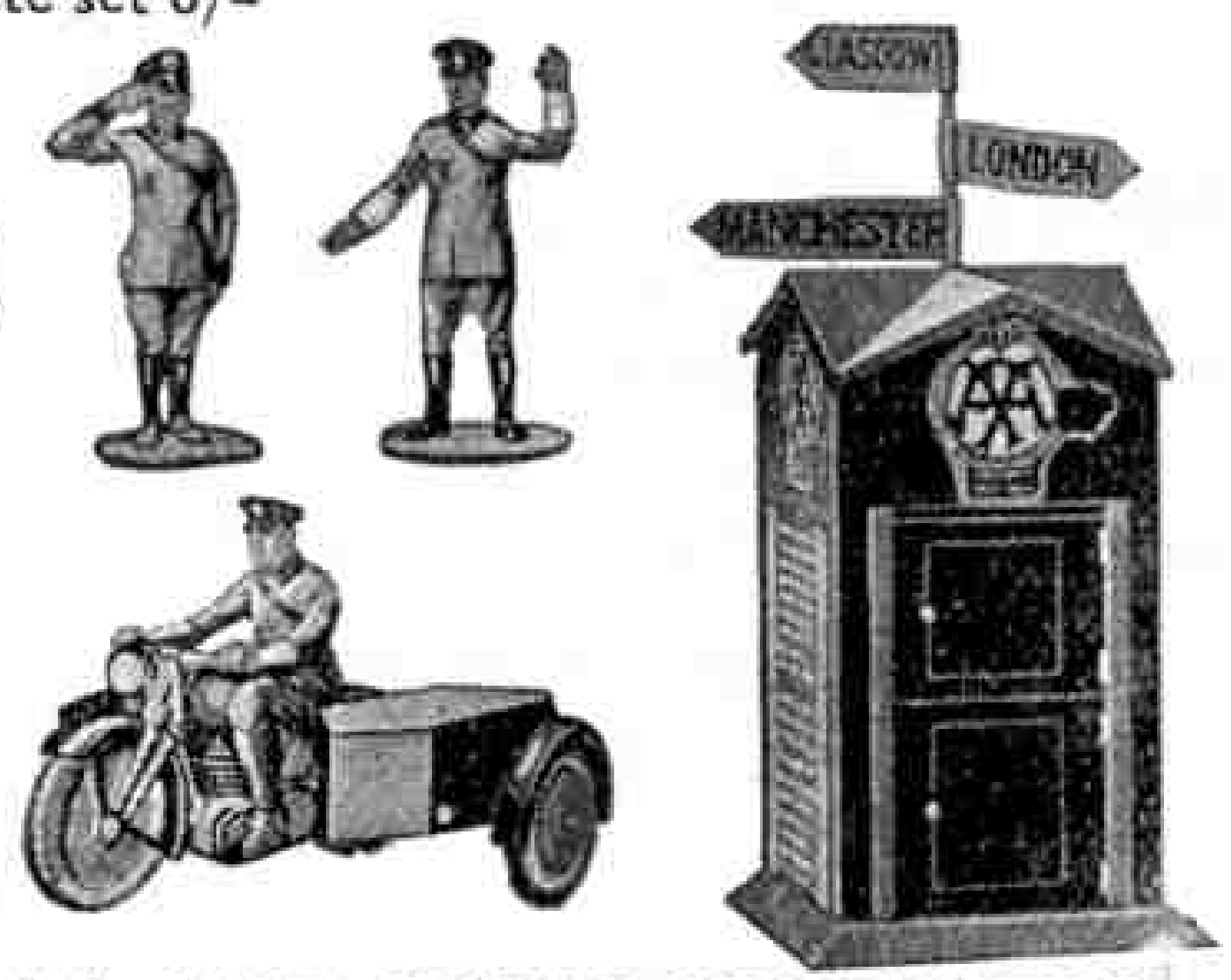
PRODUCT of MECCANO LIMITED LIVERPOOL



R.A.C. HUT, MOTOR CYCLE PATROL AND GUIDES
Dinky Toys No. 43
This set is representative of the familiar personnel and road hut of the R.A.C. Each item is finished in correct colours.

No. 43a	R.A.C. Hut	... each 6d.
No. 43b	R.A.C. Motor Cycle Patrol	„ 9d.
No. 43c	R.A.C. Guide directing traffic	„ 3d.
No. 43d	R.A.C. Guide at the salute	„ 3d.

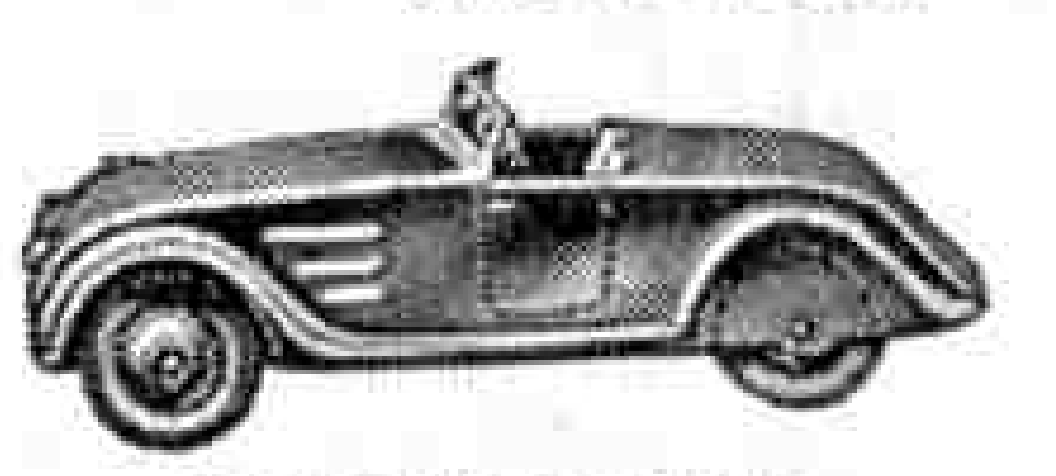
Price of complete set 1/9



A.A. HUT, MOTOR CYCLE PATROL AND GUIDES
Dinky Toys No. 44
Every collector of Dinky Toys will find this new addition to the range of particular interest. Each item is finished in correct colours.

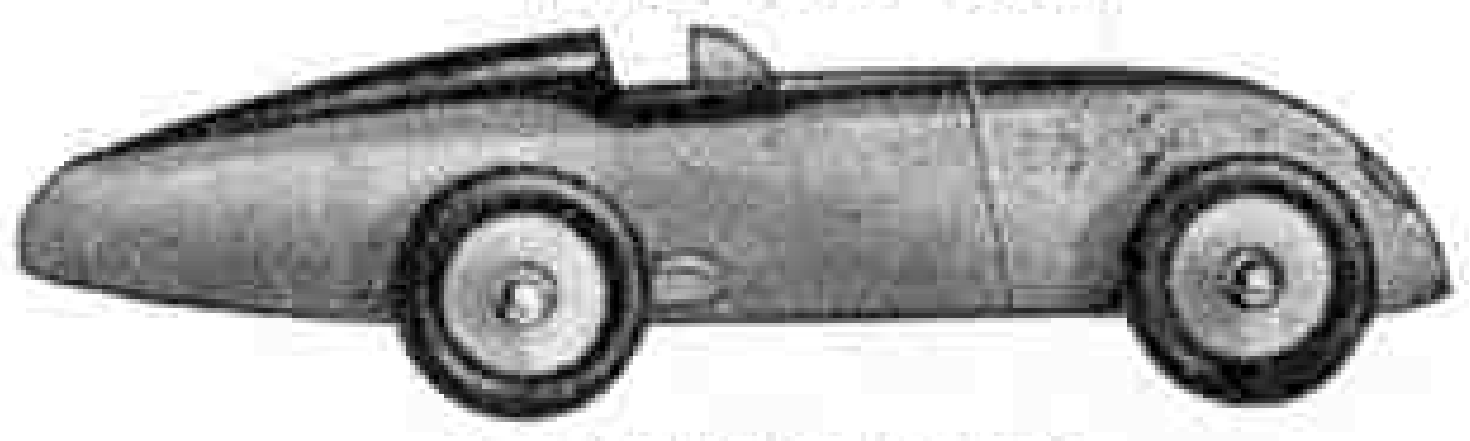
No. 44a	A.A. Hut ...	... each 8d.
No. 44b	A.A. Motor Cycle Patrol	„ 9d.
No. 44c	A.A. Guide directing traffic	„ 3d.
No. 44d	A.A. Guide at the salute	„ 3d.

Price of complete set 1/11



STREAMLINE TOURER
Dinky Toys No. 23g
Assorted colours. Fitted with rubber tyres.
Price 6d. each

TRAILER
Dinky Toys No. 25g
For use with Dinky Toys (Commercial Motor Vehicles) No. 25. Fitted with rubber tyres.
Price 7d. each.



RACING CAR
Dinky Toys No. 23a
Assorted colours. Fitted with rubber tyres. Price 4d. each

Ask your dealer for a complete illustrated list of Dinky Toys

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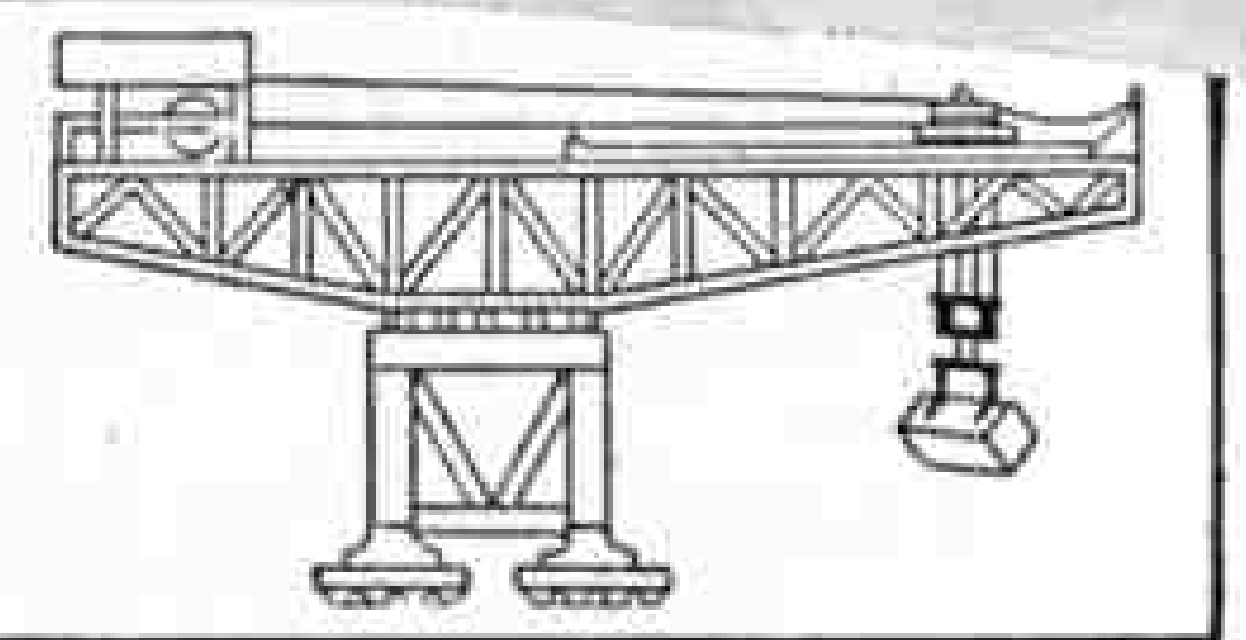
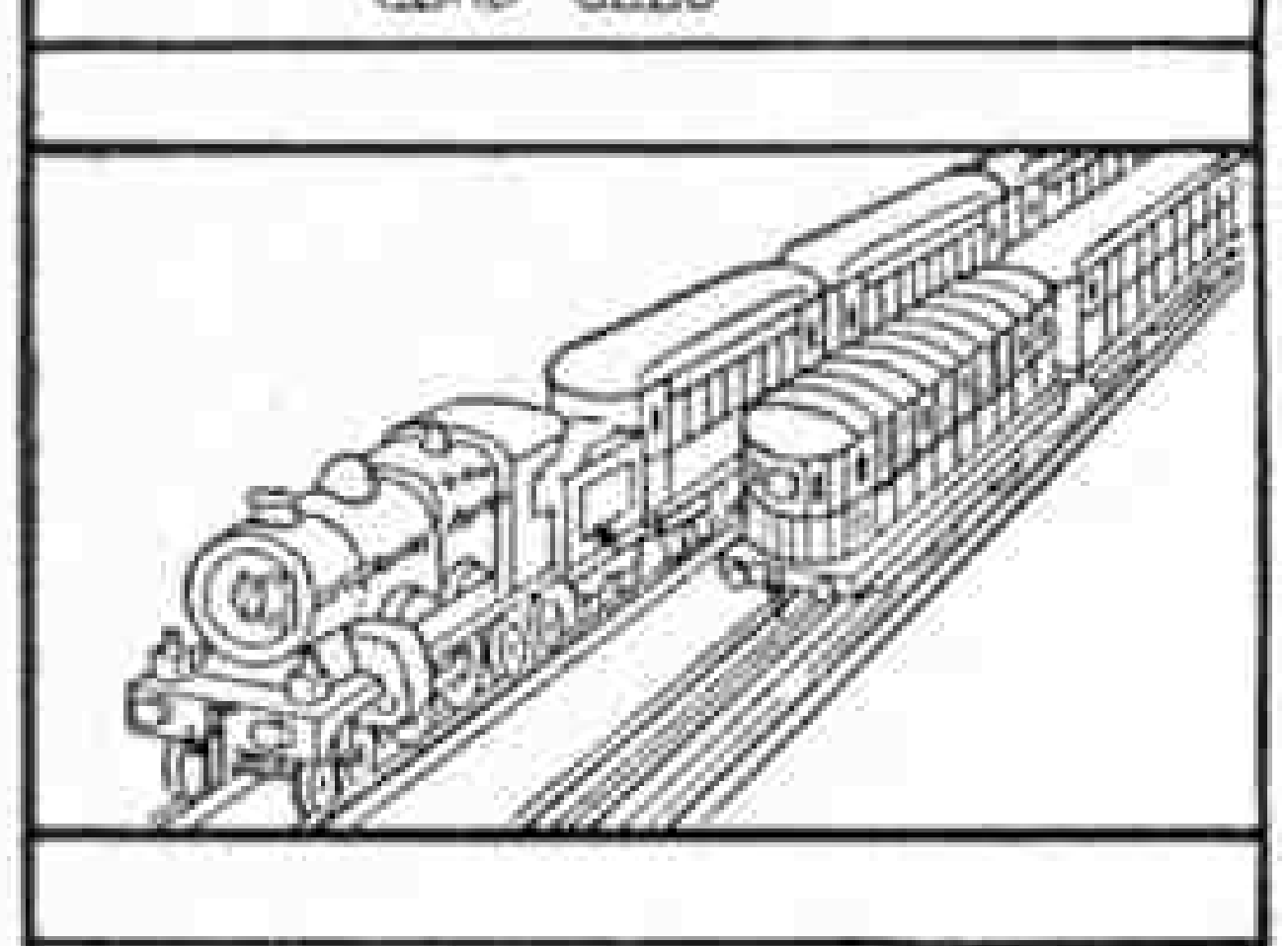
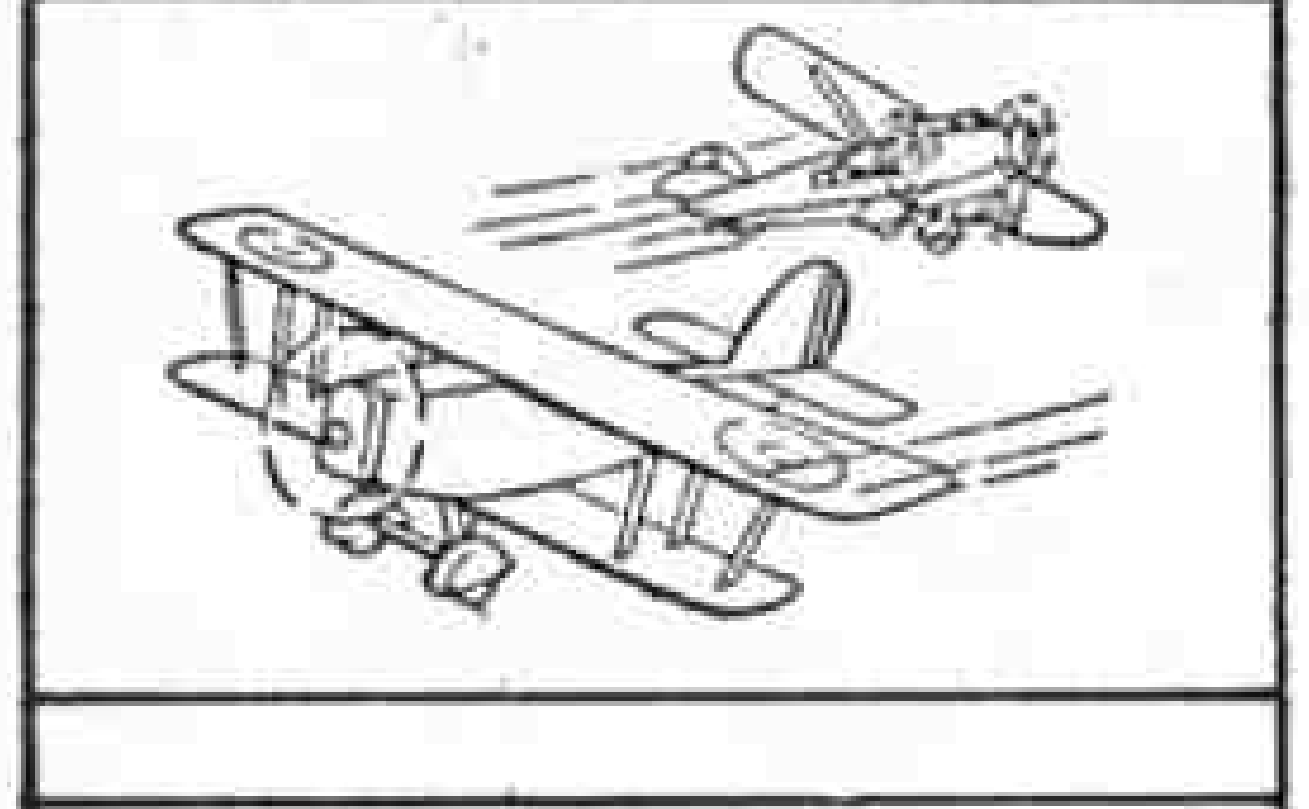
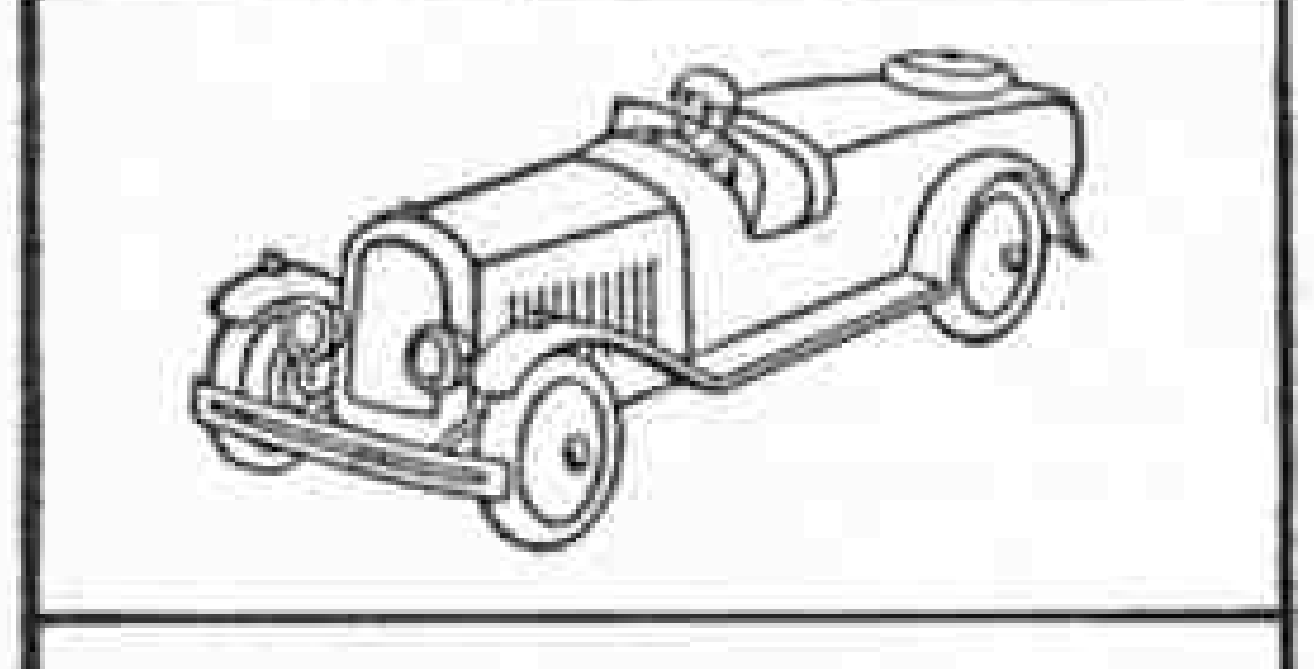





Brimful of Good News for Boys

The new "Book of Hornby Trains and Meccano Products" is the finest catalogue we have ever produced. It is beautifully printed in full colour throughout on finest quality white art paper, and its sixty pages contain the complete range of Meccano Products.

On the Meccano Outfit pages are examples of the fine models that can be built with the new-style parts finished in blue and gold. The Hornby Trains section (comprising thirty pages) will delight and satisfy the ever-increasing number of model railway enthusiasts. On other pages are featured Motor Car and Aeroplane Constructor Outfits, Dinky Builder, Kemex Chemical and Elektron Electrical Outfits, Hornby Speed Boats and Dinky Toys.

We hope that every boy in the country, and especially readers of the "M.M.," will make a point of securing a copy of this remarkable production without delay.

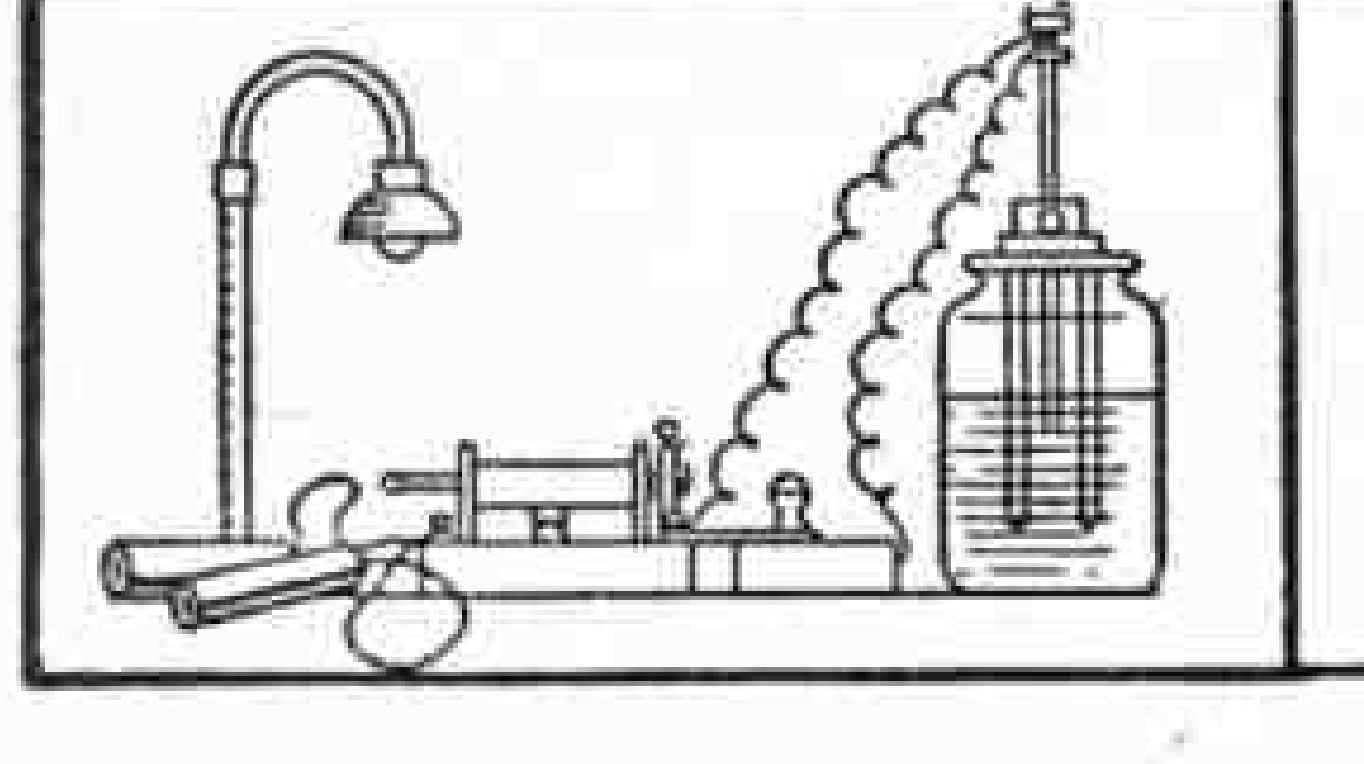
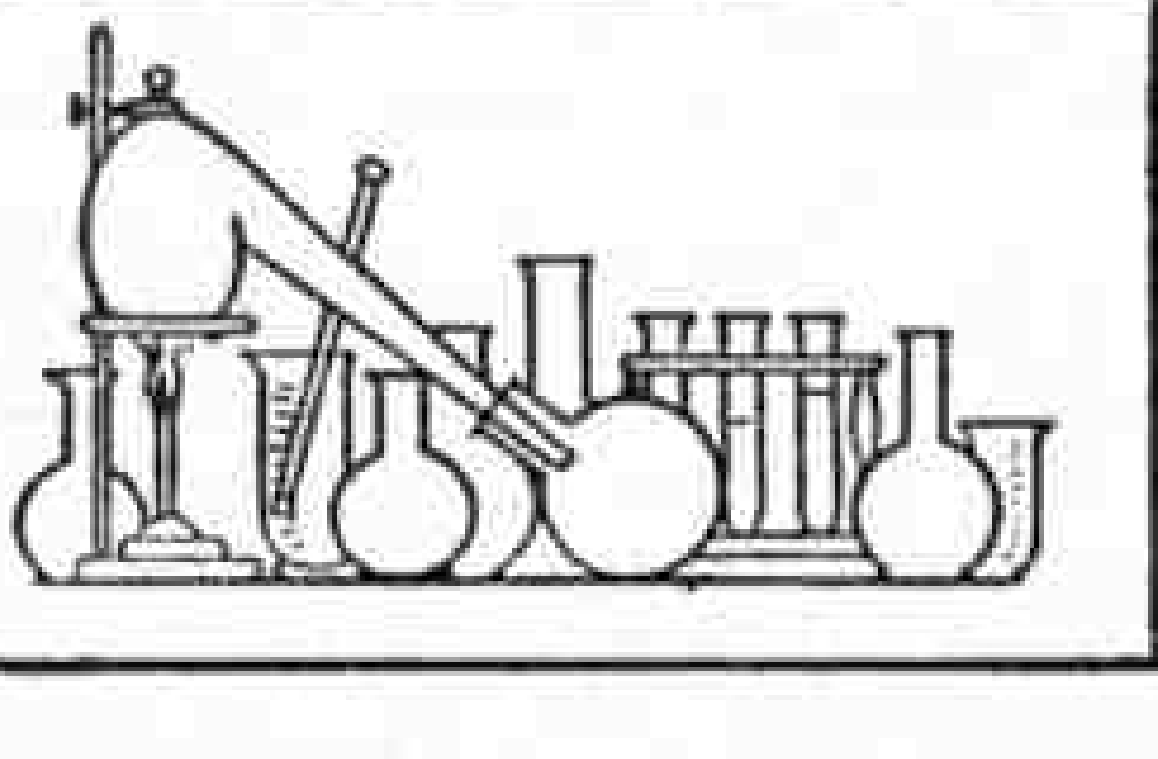
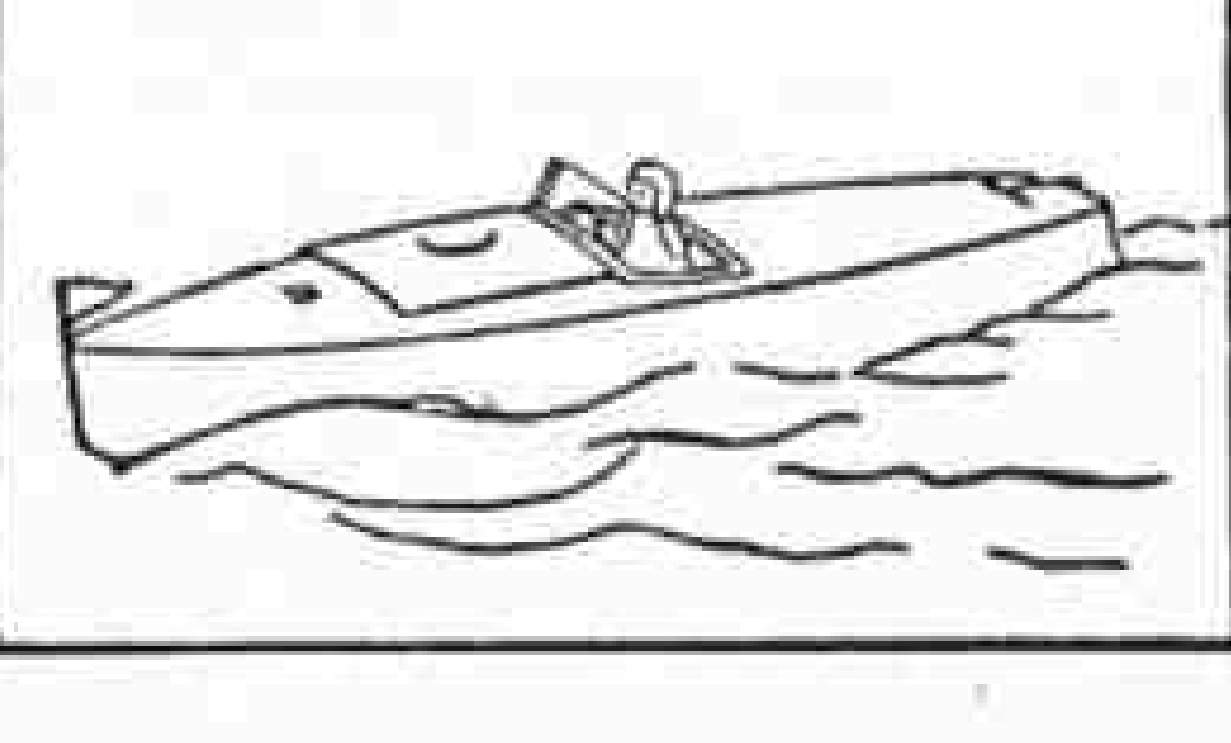
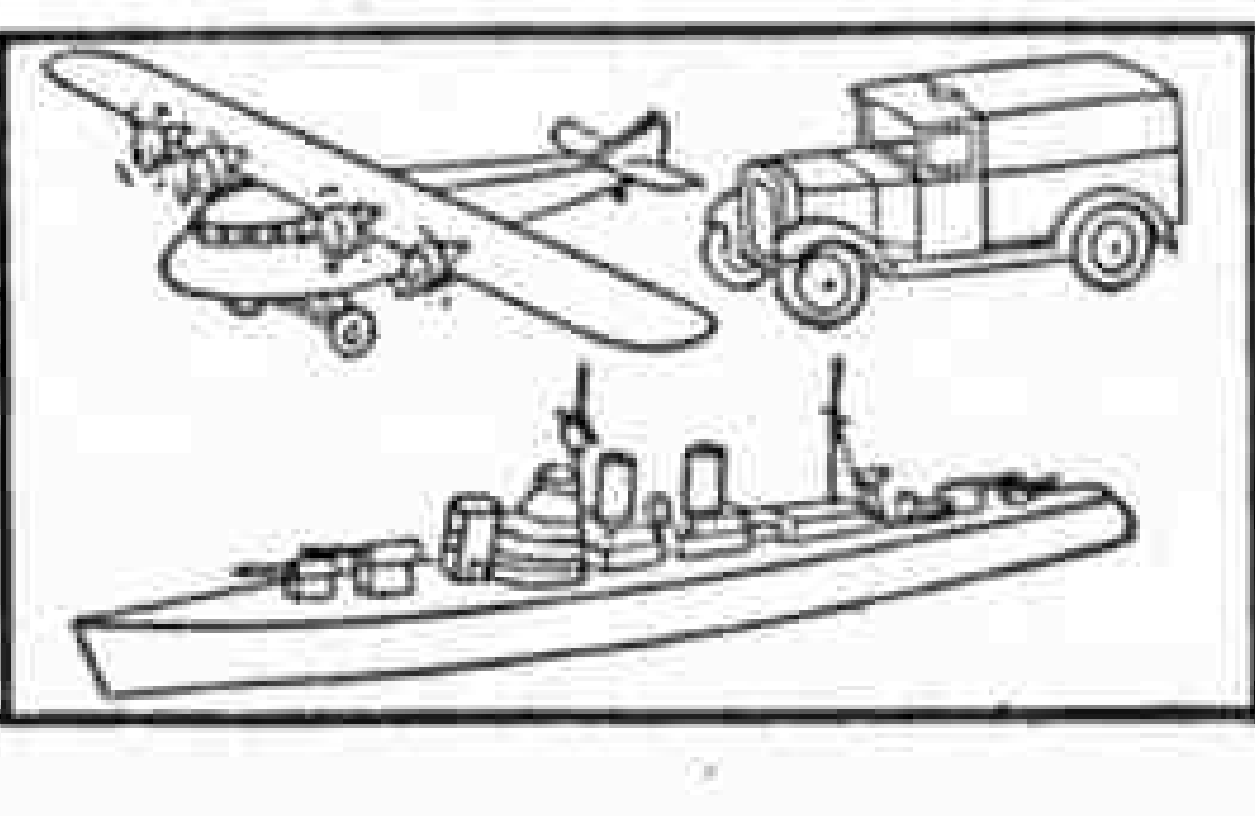
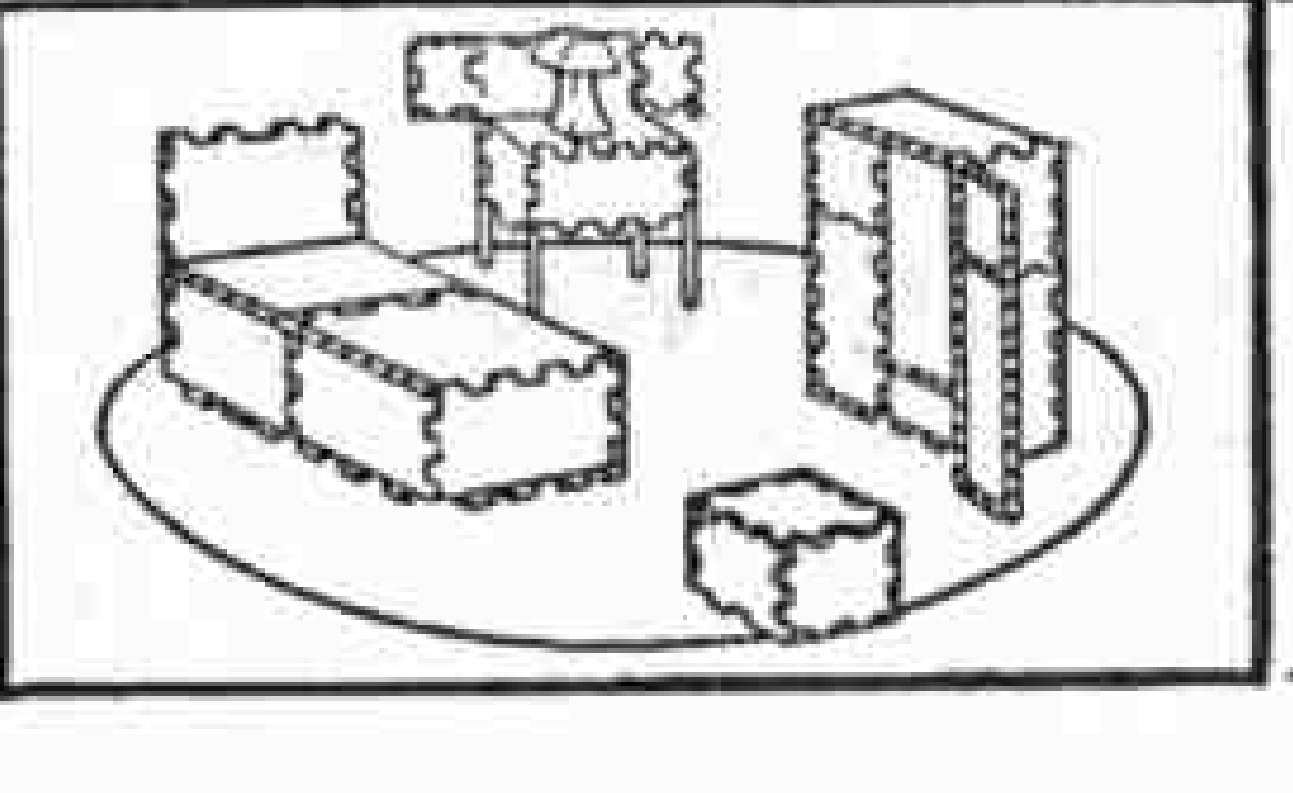
HOW TO OBTAIN THE BOOK

"The Book of Hornby Trains and Meccano Products" may be obtained from any Meccano dealer, price 9d. Alternatively, you can send in a remittance of 9d. to Meccano Limited (Dept. No. 70), Binns Road, Liverpool 13, and we will arrange for a copy of the book to be forwarded immediately, post free.

GET YOUR COPY TO-DAY

Published by

MECCANO LTD. (Dept. No. 70), BINNS ROAD, LIVERPOOL 13

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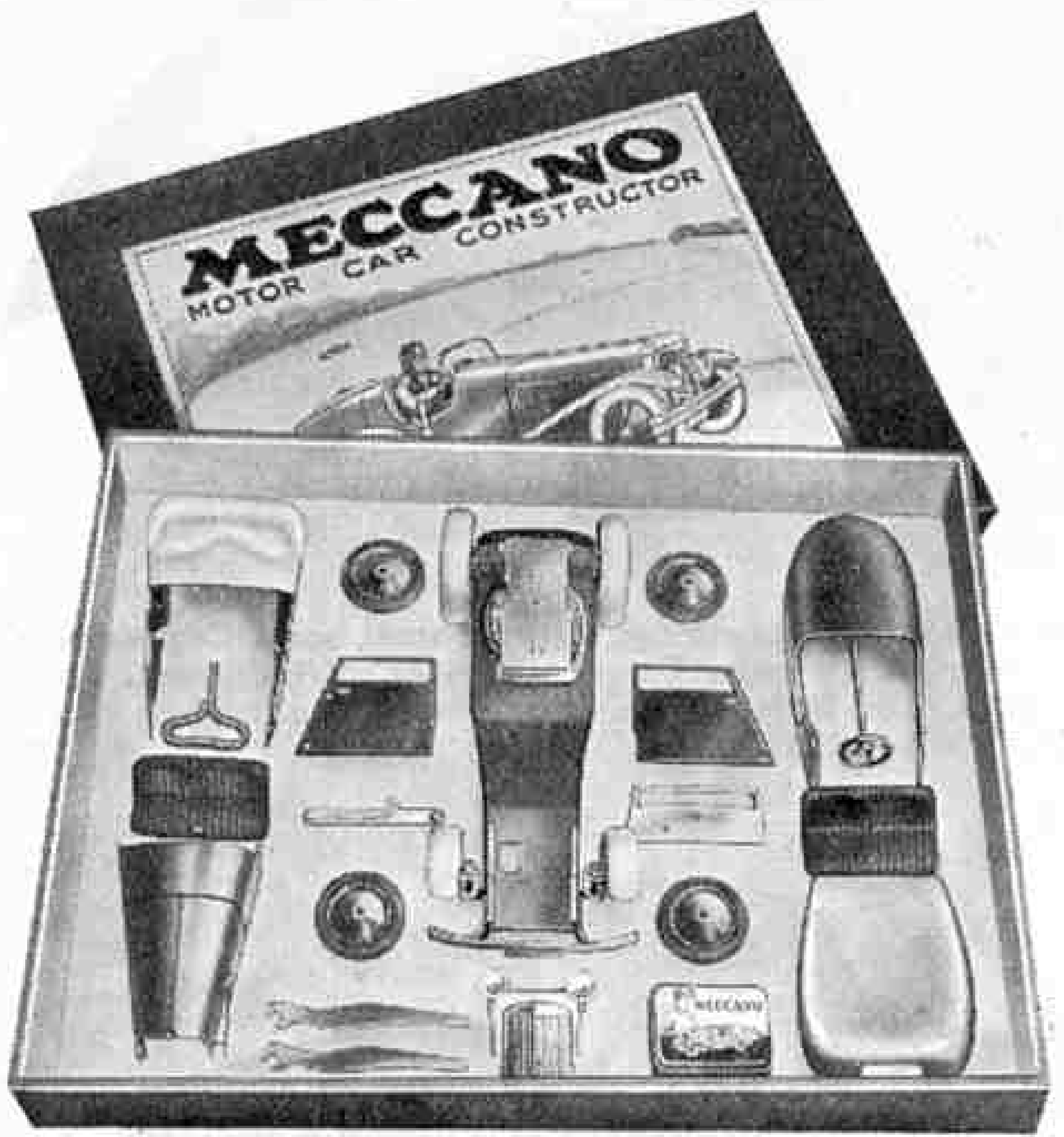
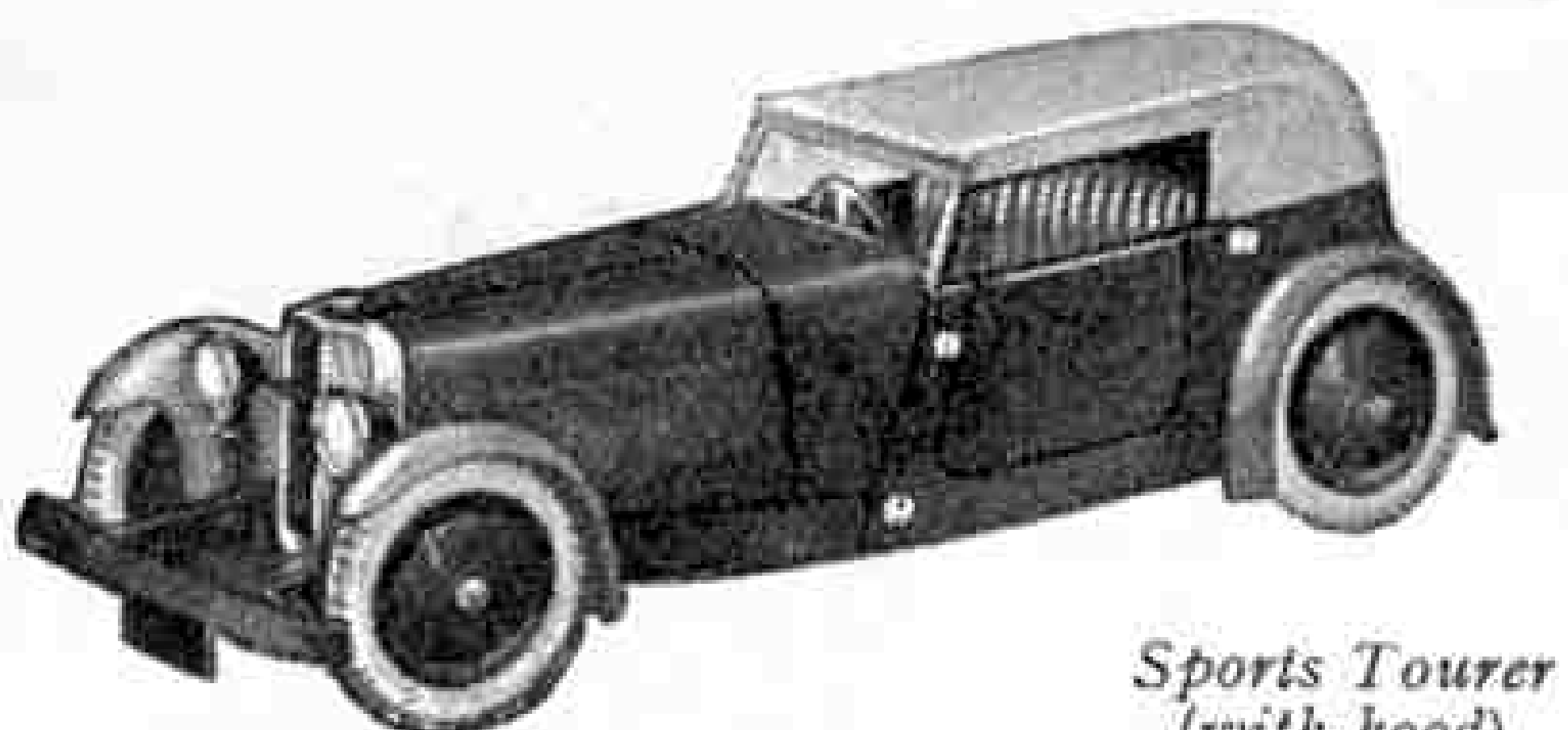
ANOTHER OF **MECCANO LTD'S** FAMOUS TOYS

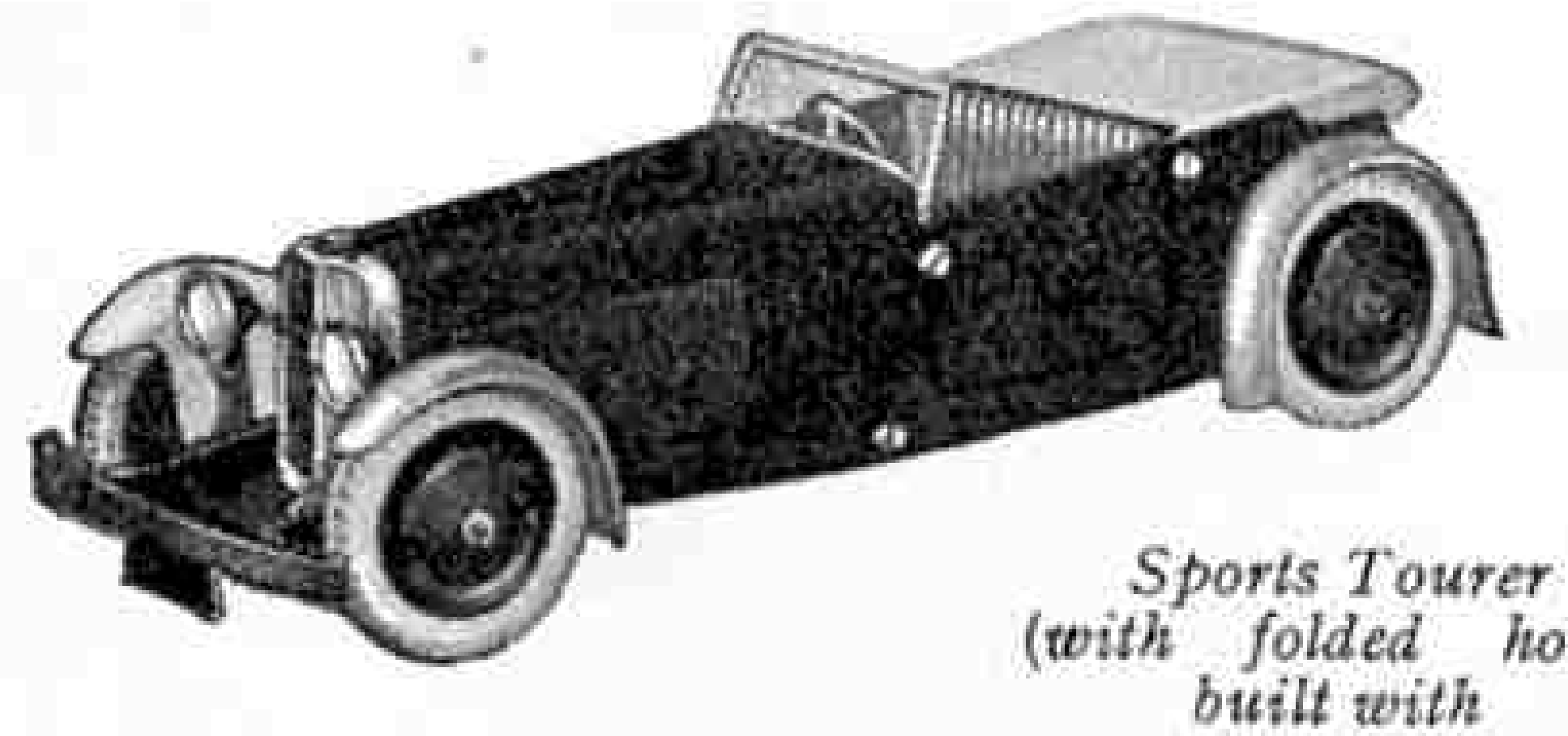
MOTOR CAR CONSTRUCTOR OUTFITS



No. 1 Meccano Motor Car Outfit



Sports Tourer (with hood) built with No. 1 Outfit



Sports Tourer (with folded hood) built with No. 1 Outfit

Boys, as soon as you see these fine Motor Car Constructor Outfits you will be keen to have one. The models they build are superb. Sports four-seaters, coupés, speed cars and other perfect miniature reproductions, each one a beautiful model of its prototype. All the models are driven by means of a powerful Clockwork Motor (included in the Outfit), giving a long, speedy and realistic run on each winding.

The motor car parts are finished in rich enamel, nickel-plate and chromium, the complete Outfits being masterpieces of miniature automobile craftsmanship.

No. 1 Motor Car Constructor Outfit

The motor car models that can be built with this Outfit are the finest you ever saw. Look at the examples shown by the accompanying illustrations and think of the fun you could have building these and other types equally realistic.

No. 1 Outfit is available in four different colour combinations and is supplied complete with powerful Clockwork Motor. Price **10/–**

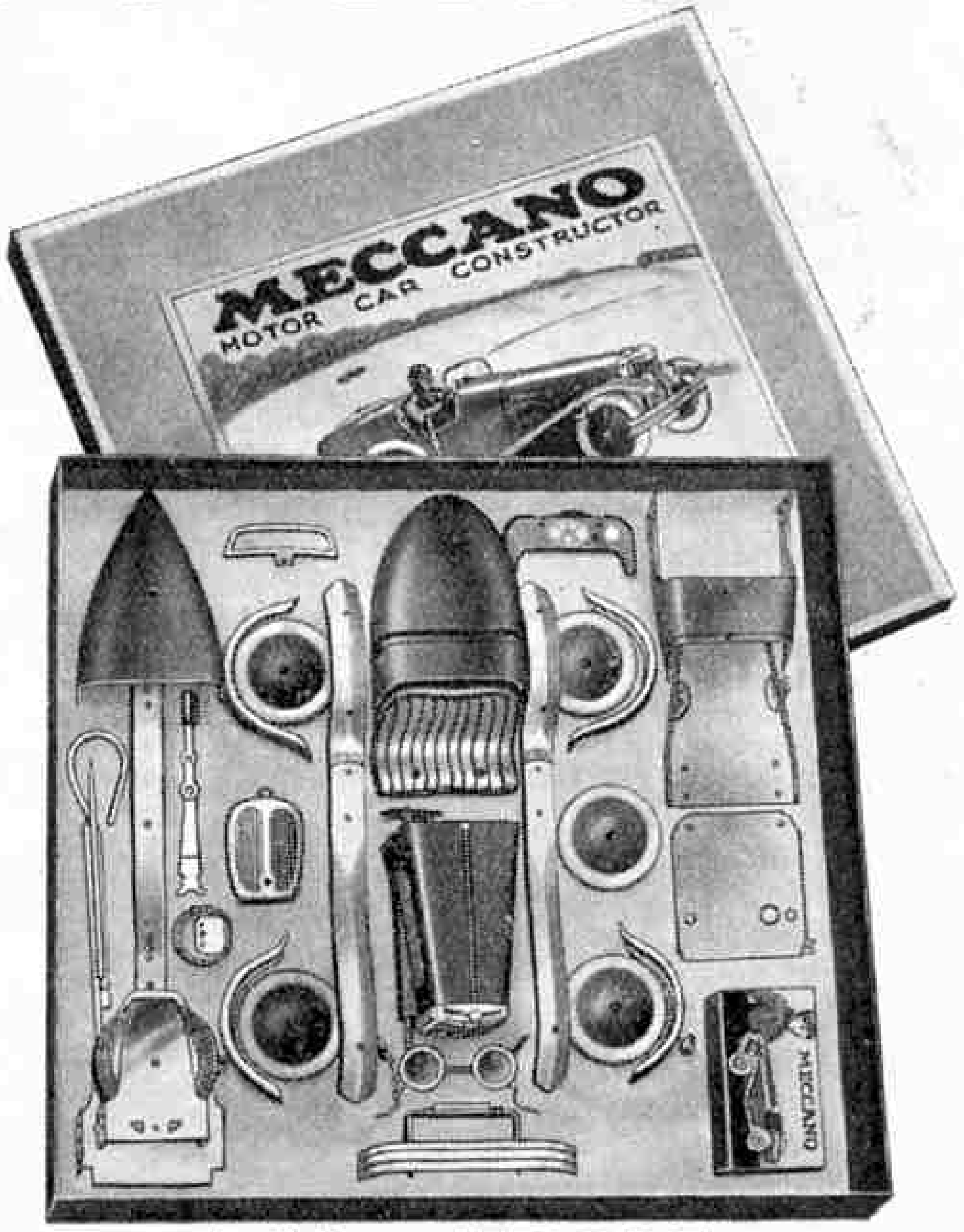
No. 2 Motor Car Constructor Outfit

Larger models of a superior type can be built with No. 2 Outfit. Their handsome and realistic appearance may be judged from the illustrations shown here.

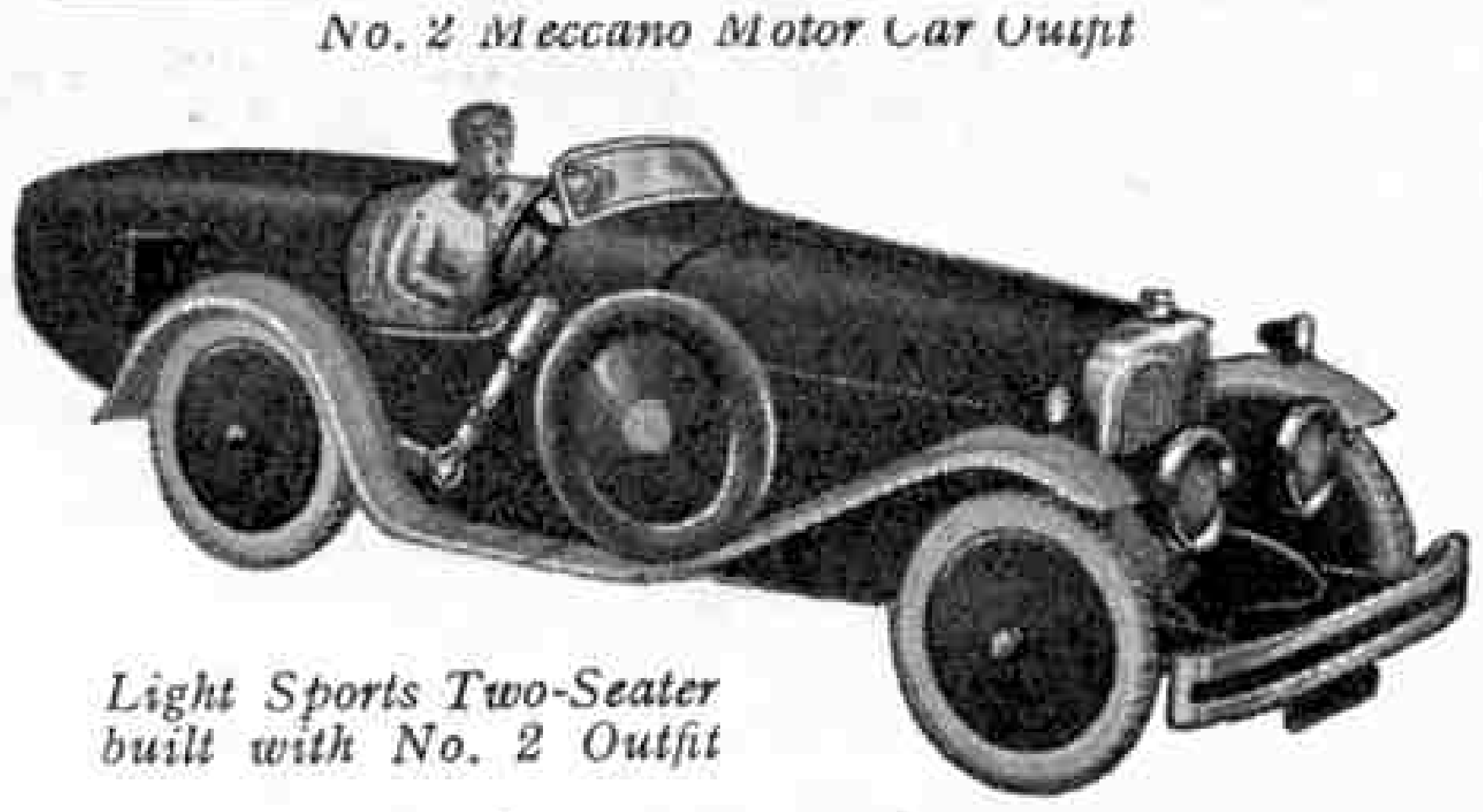
No. 2 Outfit is available in four different colour combinations, and a powerful Clockwork Motor that gives a run of 150 feet on one winding is included. Price **20/–**

Manufactured by

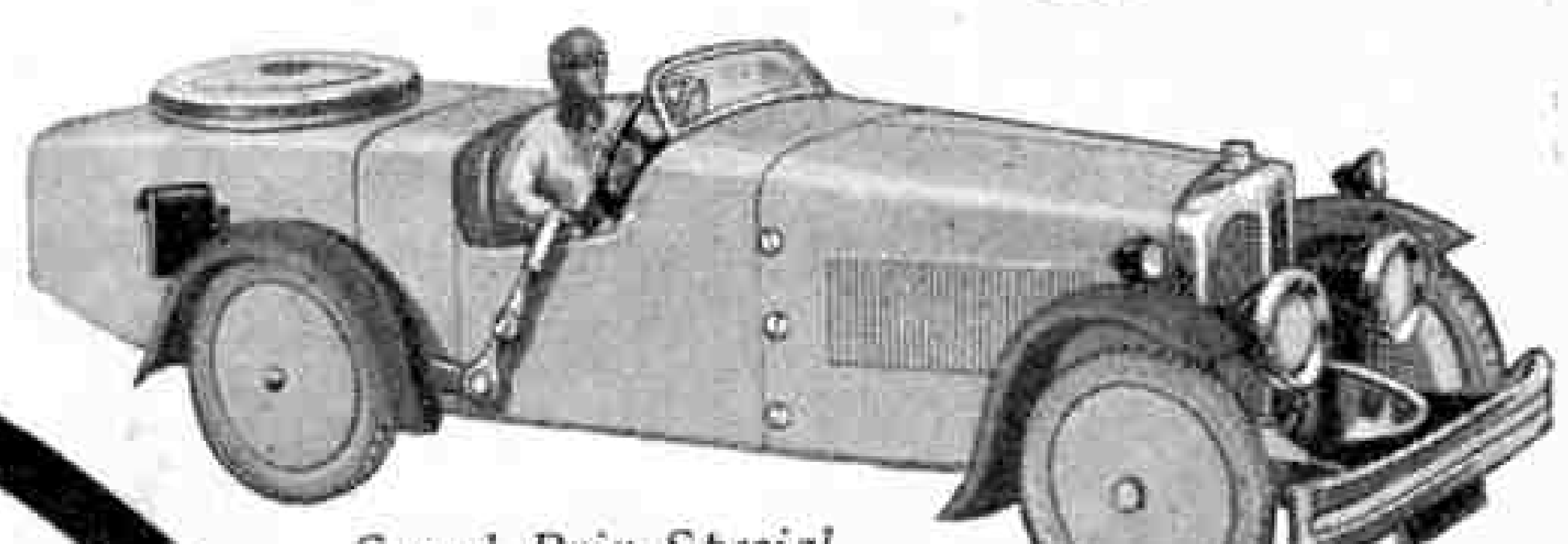
MECCANO LTD., BINNS ROAD
LIVERPOOL 13



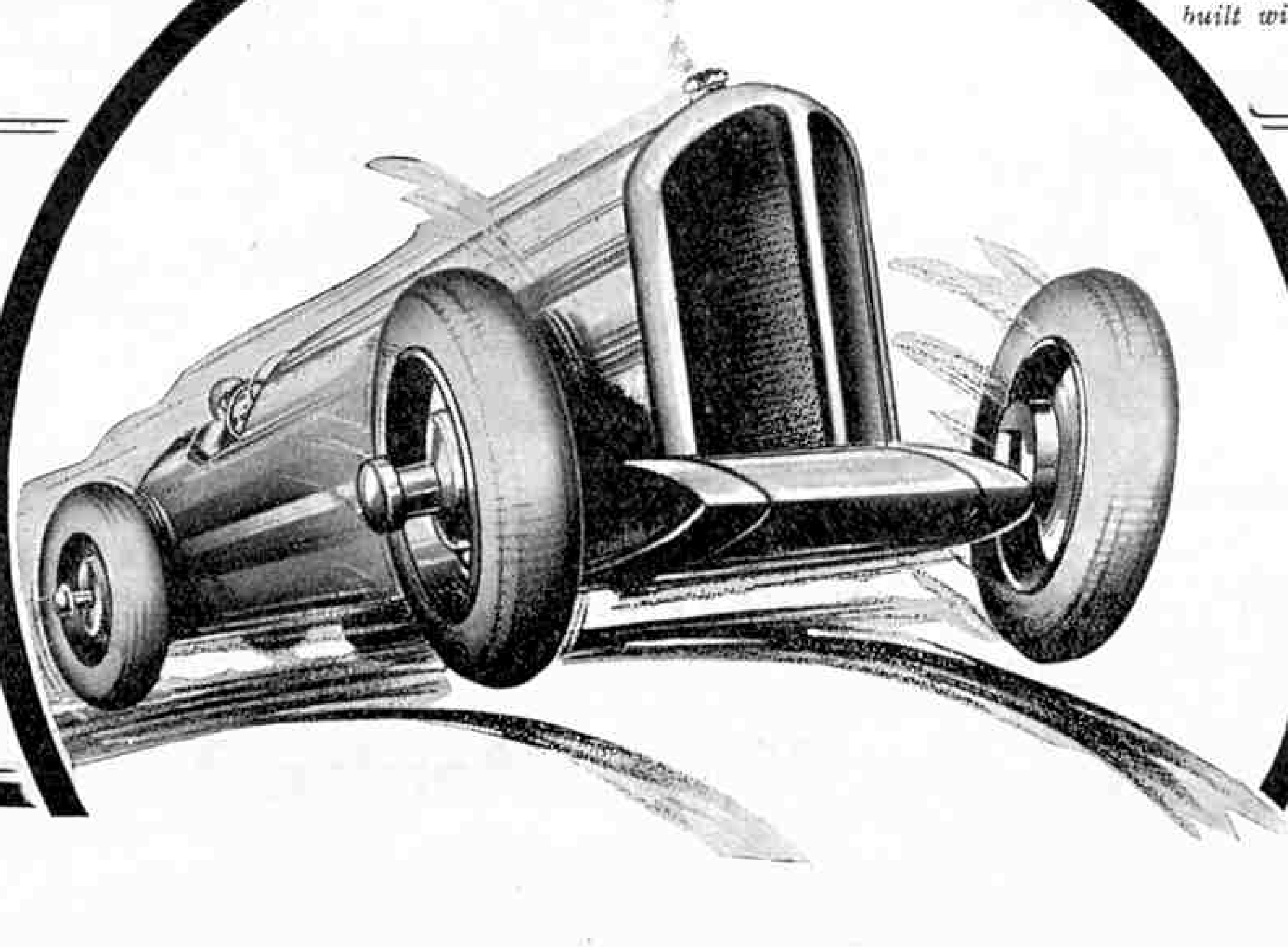
No. 2 Meccano Motor Car Outfit



Light Sports Two-Seater built with No. 2 Outfit



Grand Prix Special built with No. 2 Outfit



CHOICE RANGE OF COLOURS

Extra parts in any of the standard colours can be purchased from any Meccano dealer. In addition to the four standard colour combinations, red and light blue, light blue and cream, green and yellow, and cream and red, the following parts are available in the colours indicated:

Body Sections: orange, yellow. Wheels: orange, yellow. Wings: orange, green.

IMPORTANT.—No. 1 Motor Car Outfit parts cannot be used in conjunction with those of the No. 2 Outfit.

MOTOR CAR GARAGE

This realistic Motor Car Garage provides accommodation for any Meccano model motor car or other cars of suitable size. Inside dimensions: Height 5 in., Length 13 in., Width 7⅜ in. Price **5/6**

MOTOR CAR LIGHTING SET

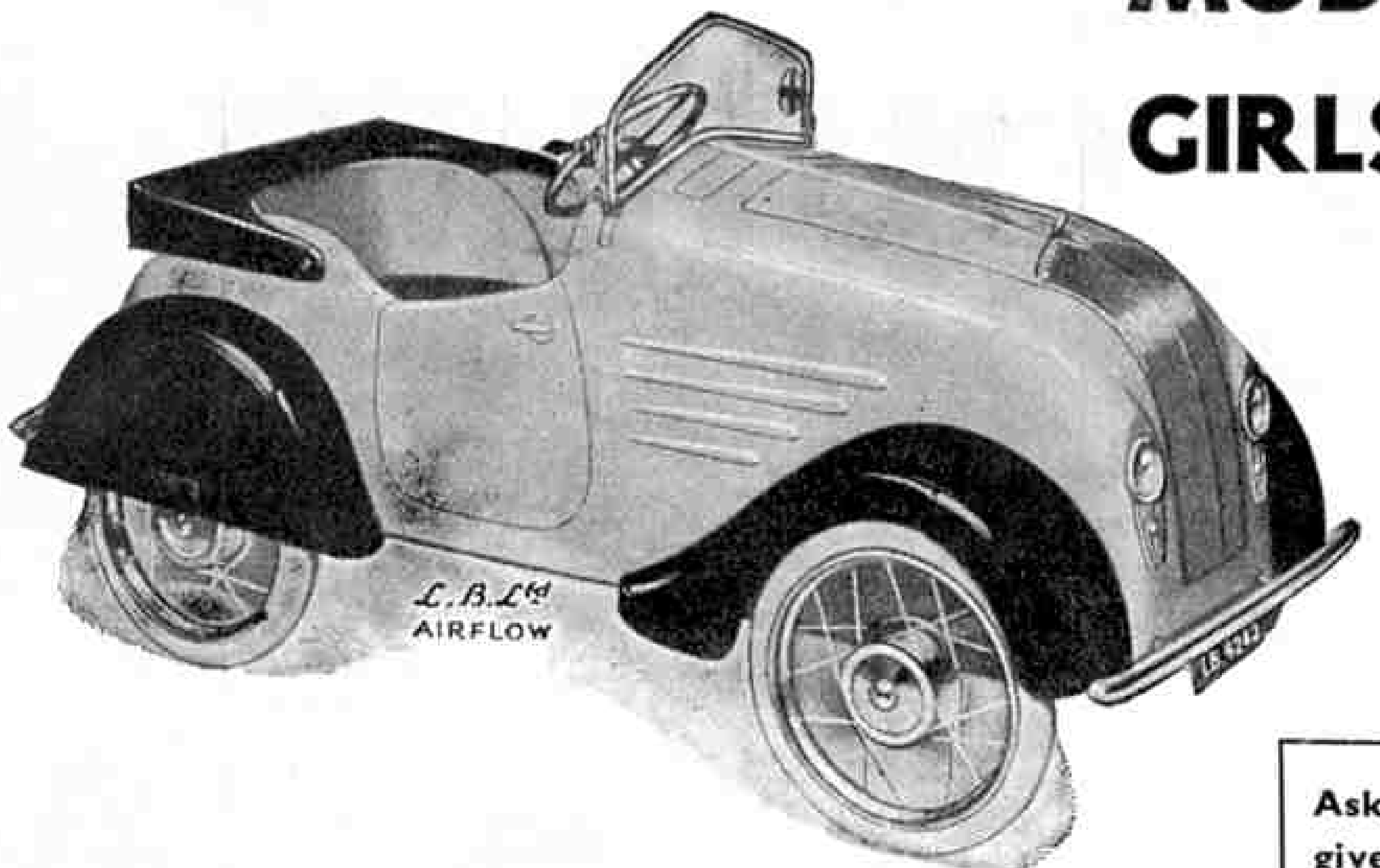
The Lighting Set enables the headlamps of Motor Car models built with the No. 2 Motor Car Outfit to be electrically lighted. Price **2/6**

TRI-ANG

Regd. Trade Mark

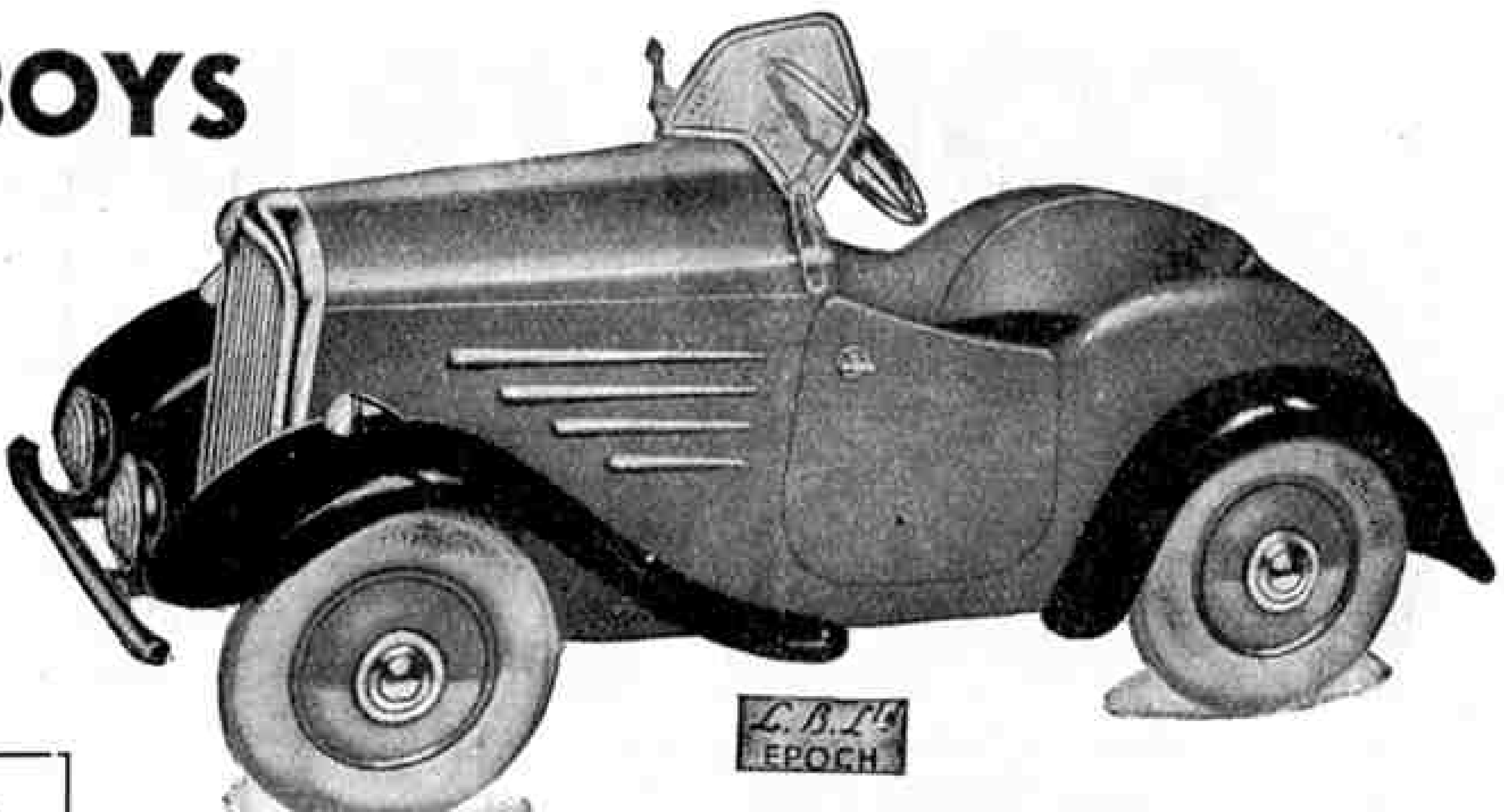
Regd. Trade Mark

MODERN TOYS FOR GIRLS AND BOYS

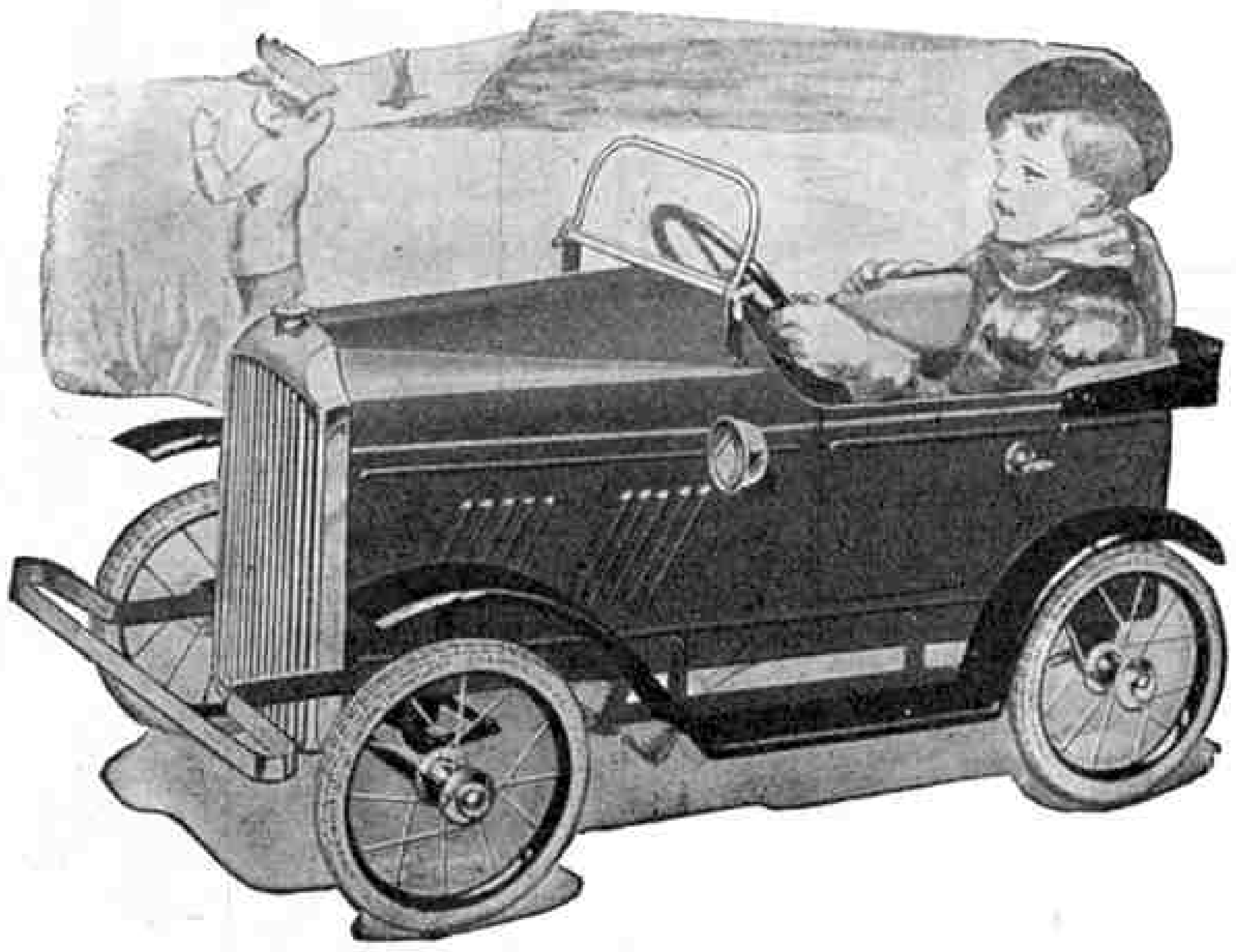


AIRFLOW. A really luxurious car, all steel body, tubular chassis. Chain and crank drive. Opening side door. Dummy hood. Tubular bumpers back and front. Facsimile Airflow radiator with mascot. Two electric headlamps and two dummy side lamps. Adjustable seat. Tangent spoke wheels with 10 x 1½ in. jointless sponge rubber tyres, CHROMIUM PLATED HUBS AND RIMS. Length 45 ins. **90/-**

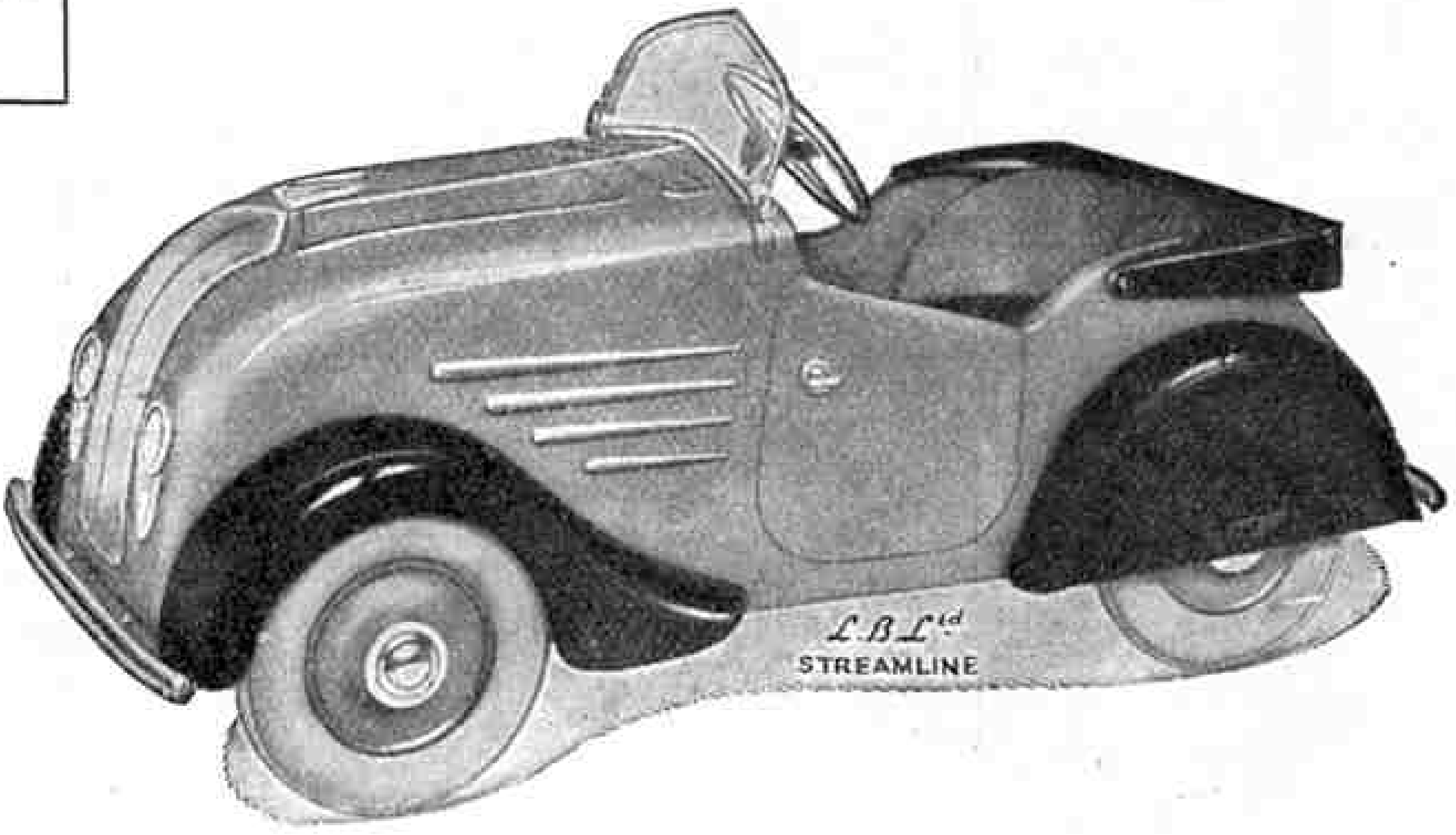
Ask your dealer to give you one of the 1935 TRI-ANG TOY coloured leaflets. There are heaps of new toys from which to choose.



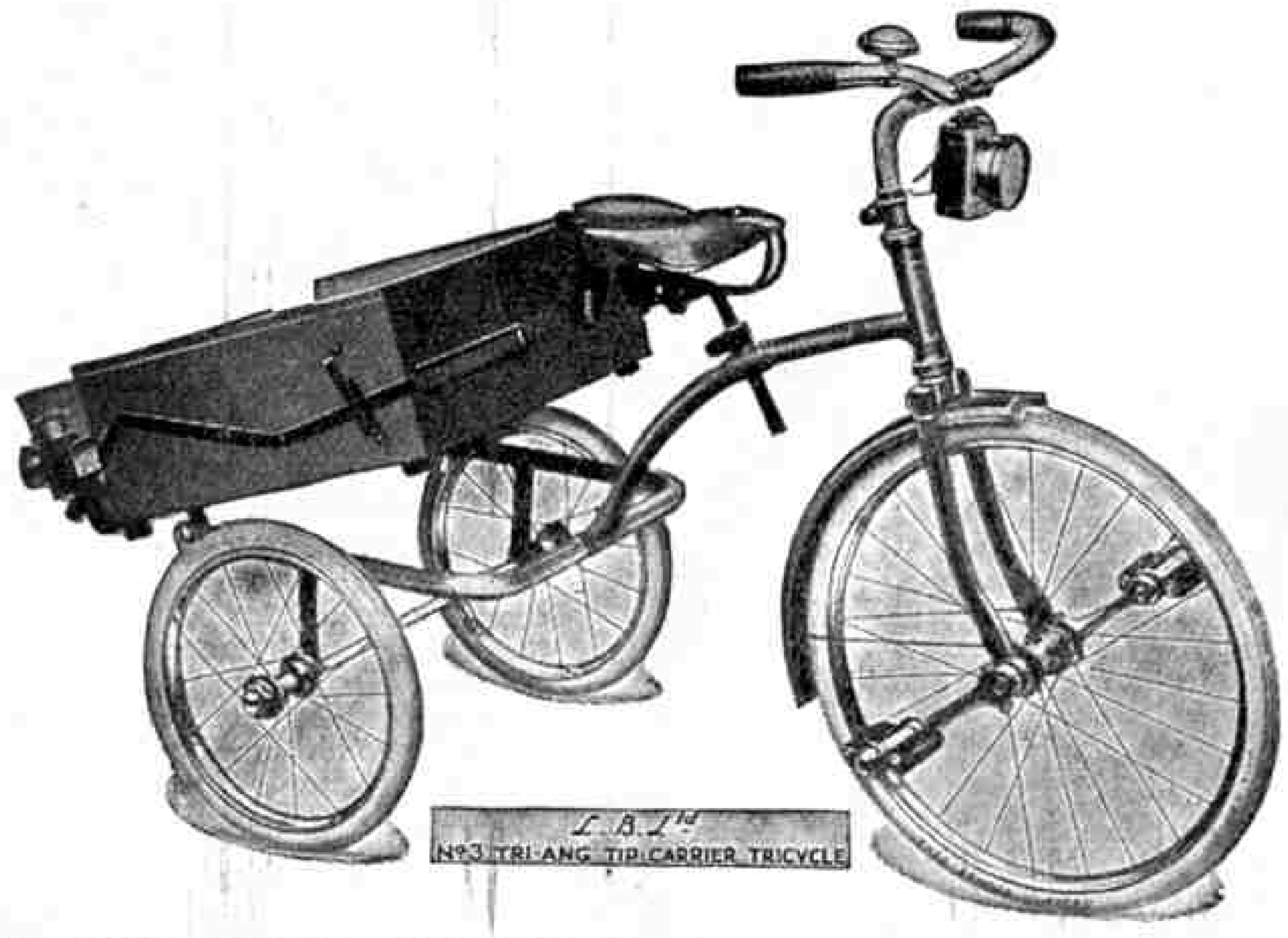
EPOCH. Latest type sports car, with all steel body. Crank drive on ball bearing back axle. Tubular bumper. Windscreen. Four dummy lamps, 9 in. Balloon disc wheels with ⅝ in. rubber tyres. Adjustable seats. Length 45 ins. **49/6**



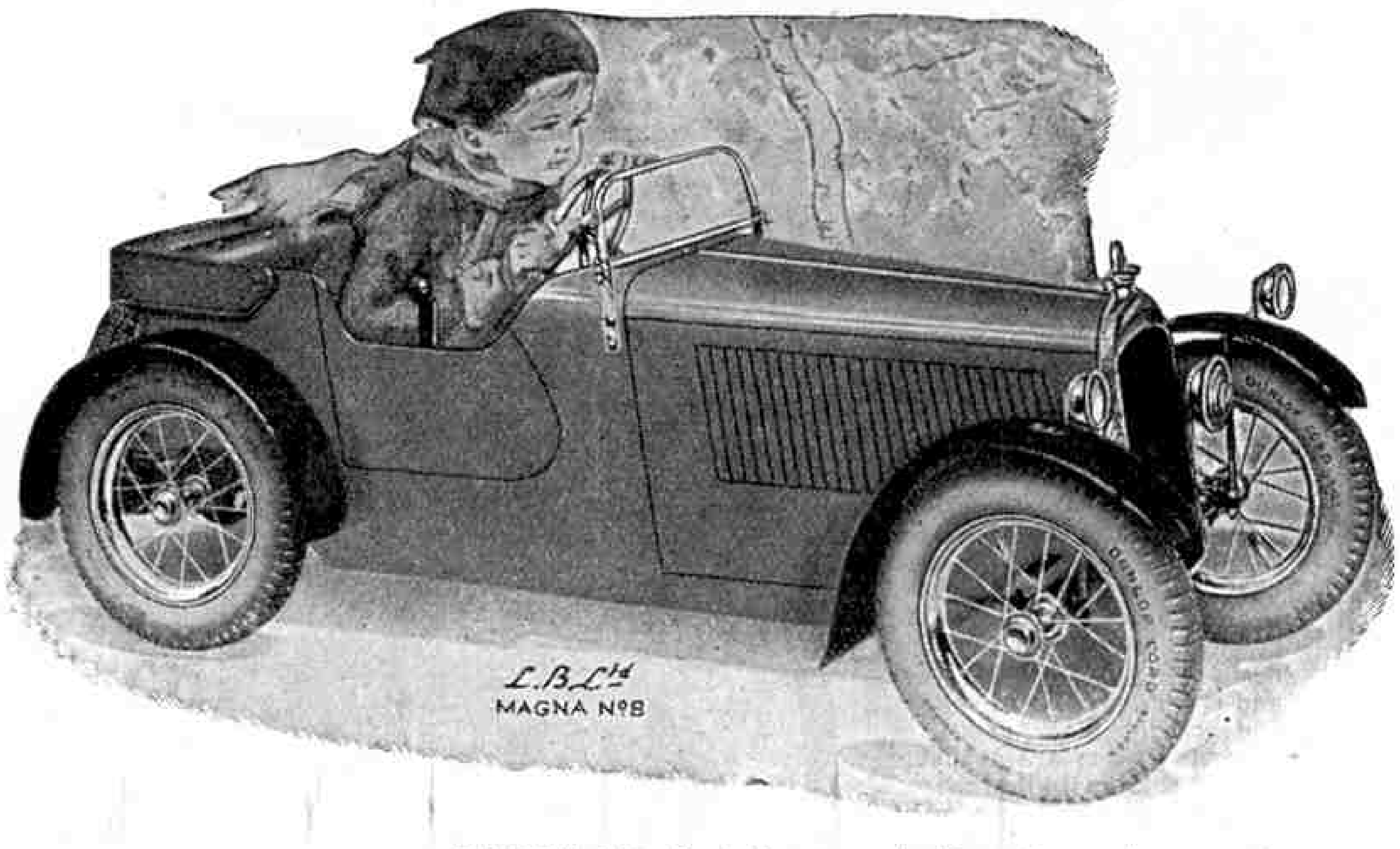
VAUXHALL CADET. A realistic model with facsimile Vauxhall radiator. Opening side door. Adjustable windscreen. Tubular bumper. Two dummy side lamps, 1¼ in. Jointless sponge rubber tyres on tangent spoke wheels. Length 35 ins. **39/6**



STREAMLINE. A real streamline body made of steel. Crank drive on ball bearing back axle. Facsimile Airflow radiator. Four dummy lamps. Tubular bumpers back and front. Windscreen and direction indicator, 9 in. Balloon disc wheels and ⅝ in. rubber tyres. Length 45 ins. **55/-**


L.B.Ltd
No3 TRI-ANG TIP CARRIER TRICYCLE

No. 3 TRI-ANG TIP CARRIER TRICYCLE. New model with CHROMIUM PLATED fittings. Strongly made of best weldless steel cycle tubing. Ball bearings throughout. Leather saddle. Tangent spoke wheels, 1½ in. Jointless sponge tyres. Fitted with box at rear and special tipping gear. **79/6**



MAGNA No. 8. A fine reproduction of a modern sports car. Wooden body. Tubular front axle. Ball bearing back axle. Band brake. Four sporting mudguards. Dummy hood. Adjustable windscreen. Dunlop 2¼ in. pneumatic tyres on tangent spoke wheels. CHROMIUM PLATED FITTINGS. Length 54½ ins. **109/6**

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NEXT MONTH: "MOTOR LIFE-BOATS OF THE R.N.L.I." PUBLISHING DATE: 1st JANUARY

MECCANO
MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Vol. XX. No. 12
December, 1935

With the Editor

How Readers Can Help

This issue brings us to the end of still another year of steady progress. I have recently been looking over a file of the early issues of the magazine, and I have been greatly struck with the remarkable way in which the contents have developed. Year by year, in accordance with the demands of readers, new topics have been introduced. At first they appeared in a small way, and then, when it became clear that they met with the approval of the majority of readers, they were developed steadily and became regular features.

I want this progress to continue. Good as the "*M.M.*" is to-day, I am confident that it can be still further improved, and I want readers to help me to achieve this aim. I want every reader to write to me from time to time and give me his opinion of the contents of the most recent issue of the magazine, telling me quite frankly what he likes and what does not appeal to him. In this way I shall be able to get in personal touch with my readers, and thus to gain a real understanding of their requirements. Many of the features of the magazine that are now most popular have been introduced directly as the result of readers' suggestions; and other features that turned out to be less popular have been either dropped altogether or greatly changed in some way. Quite apart from all this, however, I value such correspondence because it develops a "correspondence friendship" between my readers and me, and this is the next best thing to an actual personal friendship.

The Editor
wishes every reader
a very
Merry Christmas

The majority of old readers do not require any persuasion to write to me, for they already look on me as a friend. I want new readers, who so far have hesitated to write, to take the plunge immediately. I want them to tell me of their interests and ordinary daily doings, and above all to let me know of their difficulties, whether these be concerned with building models, or with bringing up a family of rabbits!

Plans for the Future

Looking back over my correspondence during the year, it seems quite clear that there is a big demand for more articles and notes dealing with ships and with motor cars, and I have a great deal of interesting material on these topics in preparation. I think every reader will enjoy the article in this issue entitled "*Southampton to Havre by 'St. Briac'*" by Mr. O. S. Nock, and I am glad to say that Mr. Nock will contribute other articles of a similar nature dealing with different sea trips. The footplate trips so vividly described by "A Railway Engineer" will be continued, and I have some interesting schemes on hand for articles on aviation and motor racing. The present regular features will be continued, and I hope in some cases to be able to extend them.

Fun with Dinky Toys

One of the most popular recent introductions among Meccano products is the series of Dinky Toys. These fascinating miniatures appeal to everybody by their perfection of design and finish. They have already brought into existence an entirely new collecting hobby, and they are used as toys in all kinds of interesting schemes. For instance, by means of a few of the motor cars, and the robots and road signs that are among the latest additions, splendid fun may be had in working out traffic problems on the dining room table. I know of many boys who spend happy hours at this sort of thing, and incidentally they tell me that, almost as soon as the Dinky Toys are laid out on the table, Father loses interest in his evening paper and comes along to join in!

Next month I hope to publish a short illustrated article to explain the general idea of such a scheme to readers who may not yet have tried it. There is endless scope for fun of this kind, and to encourage readers to work out their own ideas I offer prizes of £1-1s.-0d., 15/- and 10/6 for the three best suggestions for table top fun with Dinky Toys. In order that every reader may have a fair chance I will keep this competition open until 31st March. Do not wait until the last minute, however; send your suggestions along soon so that I shall have plenty of time to examine them carefully. In order to make matters quite clear, it will be necessary for the suggestions to be accompanied by a sketch of the layout, but this need not deter any boy. It does not matter how rough the sketch is, so long as it indicates the idea.

The Meccano Guild

It is encouraging to note the steady progress of the Meccano Guild, the world-wide brotherhood of Meccano enthusiasts. The majority of the Meccano clubs are of course in Great Britain, where it is interesting to note the marked increase in the number of clubs associated with schools. Satisfactory progress has been made in South Africa, and an interesting recent development there has been the establishment in Pietermaritzburg of a club for coloured boys. This is proceeding on excellent lines, and its success helps to demonstrate that Meccano and the principles of the Meccano Guild appeal to boys of all races and creeds.

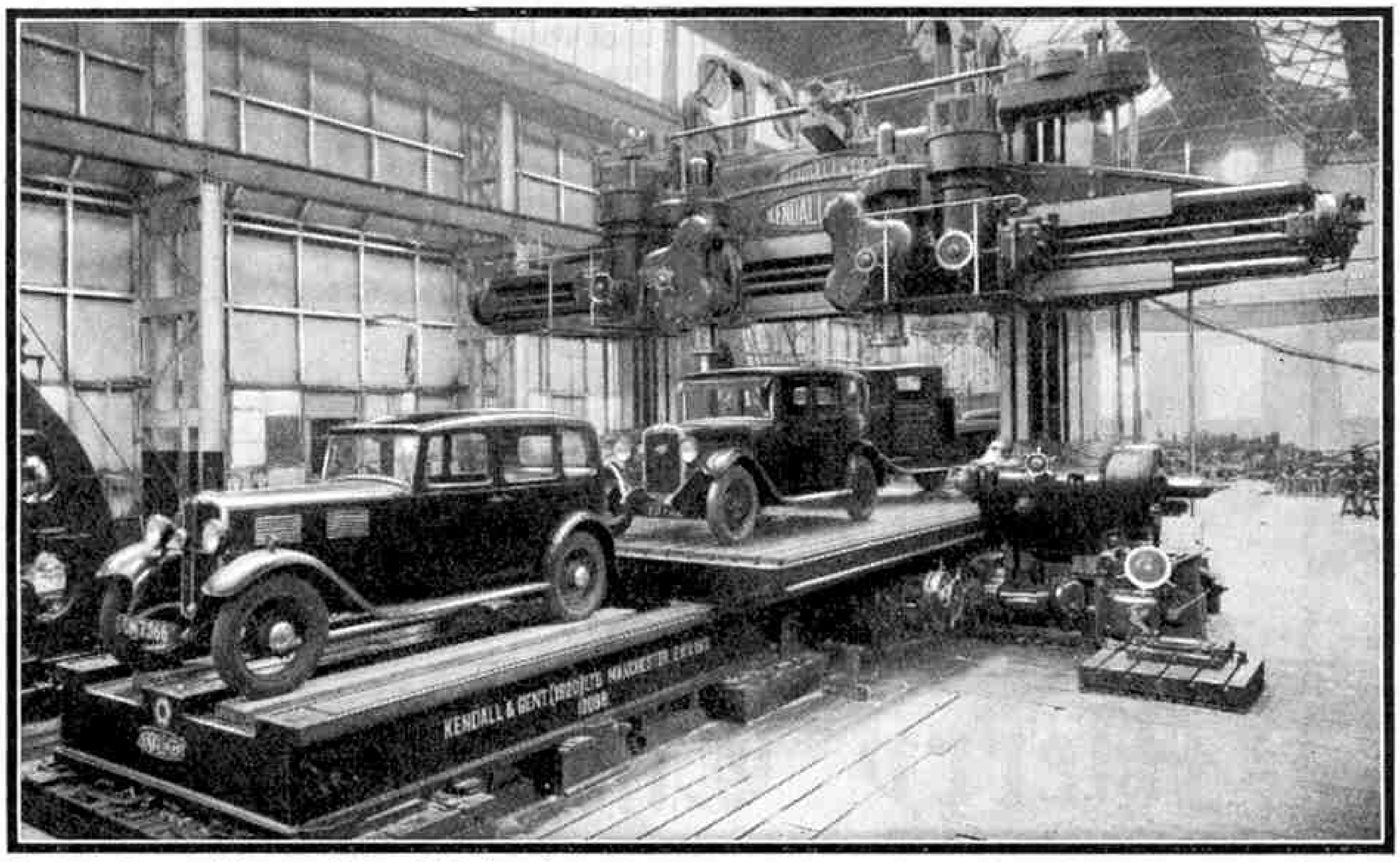
There are also flourishing Meccano clubs in Canada, **Australia** and New Zealand. The last-mentioned country is the home of the Correspondence School M.C., which must be the most remarkable club in the world. It holds no meetings in the ordinary sense, for its members never see each other! They live on lonely farms and inland sheep stations. Nearer home there are many Meccano clubs in France, Holland, Switzerland, Italy, Norway and other European countries.

Giant Plano-Milling Machine

Mammoth Tool for Handling Large Castings

SOME of the world's most wonderful mechanical devices are to be found among the machine tools that form the equipment of a modern engineering workshop. One of the most useful of these machines is the planing machine, of which there are many types, each differing in several important features. The planing machine is really a development of the lathe, and is second only in importance to it. The purpose of the lathe is to turn a cylindrical surface true from end to end, and that of the planing machine is to produce true flat surfaces.

The action of a planing machine resembles the successive cuts of the tool used on a lathe. The chief difference is that in a lathe the work turns on centres against a stationary tool, while in a planing machine the tool is fixed above the work, which is attached to a moving table that slides along the bed of the machine, carrying the work beneath, and forcing it against the tool.



A giant plano-milling machine, which is so large that two motor cars and a truck can be easily accommodated on it. Photograph by courtesy of Kendall and Gent (1920) Ltd., Manchester.

Considerable controversy has centred round the question as to who was the real inventor of the planing machine. The earliest official record we have is a patent specification taken out by Joseph Bramah, the famous engineer, in 1802. In this is described a machine for producing smooth, straight and parallel surfaces on wood and various other materials, by means of cutting tools fixed on frames driven by machinery and revolving round an upright shaft.

Another engineer who gave considerable time and thought to the design of planing machines was James Fox. It is claimed by some that he made the first really practical machine in 1814, but it is stated also that in the same year the famous Matthew Murray had a planing machine of his own make in use in his workshop. Like many other inventions of those days, Murray's machine was not patented, but was kept under lock and key in a small room to which only Murray himself had access.

Still another noted engineer who is associated with the invention of the planer and with the improvement of machine tools generally was Joseph Clement. He had a machine specially designed for planing the beds of lathes in use some years before 1820, and the success of this instrument led him to produce a more elaborate machine, which he completed and set to work early in 1825.

These early machines differed from each other in design, but the principle on which they worked was much the same in each case, and although considerable improvements have been made during the last 50 years the basic principle has remained unchanged. In recent years, however, an operation known as "milling" has become of great importance, and is now often used for certain kinds of work formerly done by planing machines.

Milling consists in the cutting of metal by means of revolving cutters or mills, and a great advantage of the process is that it enables intricate forms to be obtained quite automatically and independently of the operator, a matter of great importance when large numbers of similar parts are to be produced. It is now a common practice to incorporate both milling and planing operations in one machine, and on this page we illustrate an enormous machine of this kind that was built by Kendall and Gent (1920) Ltd., Manchester, for installation in a large workshop abroad. This machine is the largest plano-milling machine yet built in this country, and with it all kinds of heavy castings up to 12 ft. wide by 8 ft. high and 28 ft. long can be handled with comparative ease.

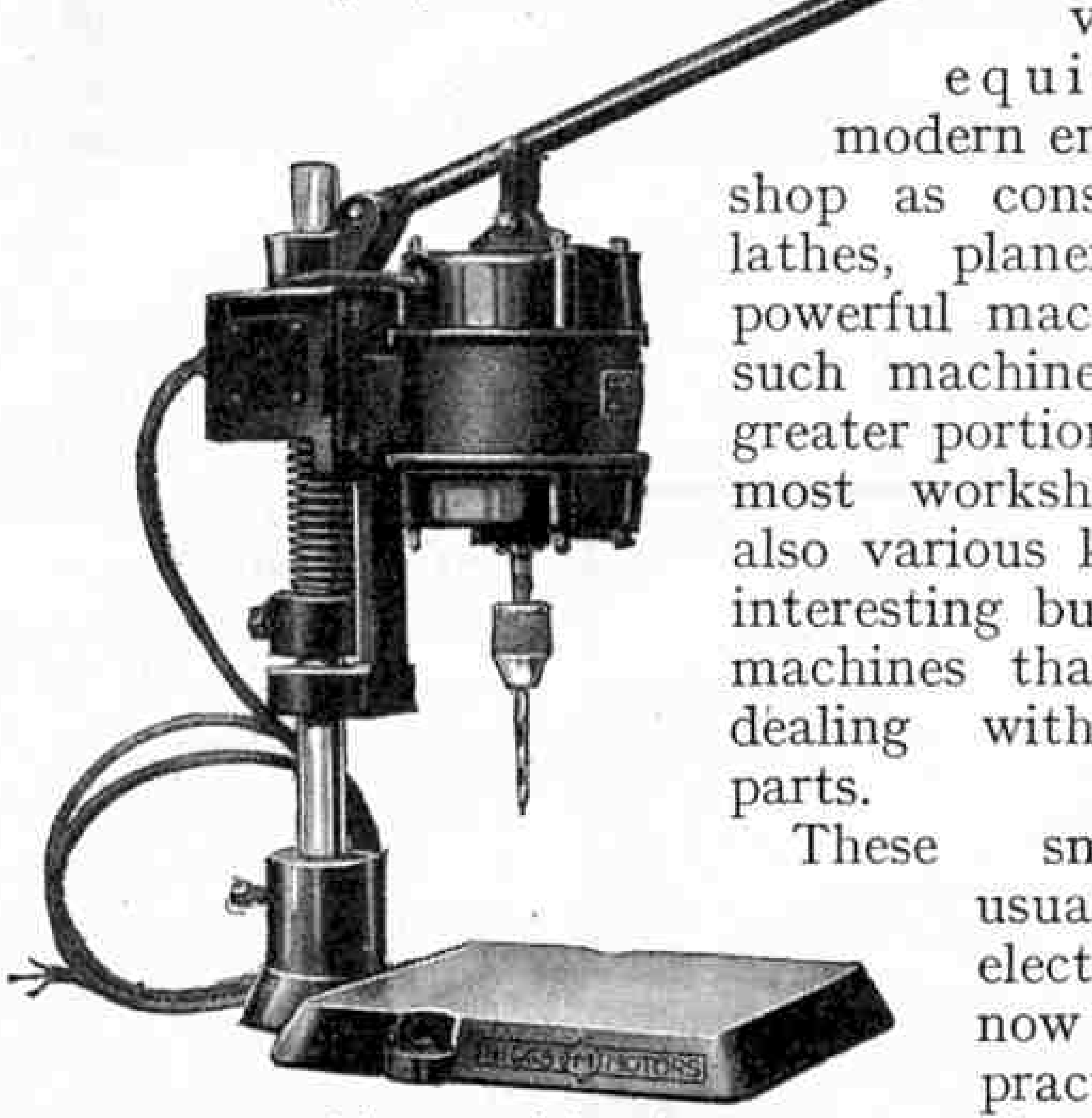
The bed of the machine is 53 ft. long and the work table is 12 ft. 6 in. wide overall, and is travelled backward and forward by long twin worms that engage with semi-circular racks. The worms are driven by a 20 h.p. electric motor, controlled from push buttons situated on each side of the machine in positions most convenient for the operator.

One of the main features of the machine is that it is equipped with four milling cutters, which enable it to work very rapidly. Two of these are fitted on a cross-slide and work in the vertical position, and one on each upright. The spindles of the left-hand vertical cutter and the left-hand horizontal cutter are arranged to swivel 20 degrees each side of the centre line.

The vertical cutter spindles mounted on the cross-slide are provided with both hand and variable self-acting reversible feed motions, and also a rapid traverse movement. The horizontal cutter saddles can be moved in the vertical plane by either hand or self-acting feed motions and all the various movements can be operated independently or simultaneously.

Small Electric Tools

Recent Developments in Workshop Equipment



A skilfully designed bench drilling machine driven by a self-contained electric motor. It will drill holes up to ¼ in. in diameter.

MOST of us visualise the equipment of a modern engineering workshop as consisting of large lathes, planers and similar powerful machines. Although such machines do form the greater portion of the plant in most workshops, there are also various kinds of equally interesting but smaller bench machines that are used for dealing with small metal parts.

These small machines usually are driven by electricity, and it is now the general practice to provide each machine with its own self-contained motor. Examples of machines of this kind are shown in the top and bottom illustrations on this page. They are a bench drilling machine and a bench grinding machine respectively, and they have recently been placed on the market by Higgs Motors Ltd. of Birmingham.

The drilling machine is of a particularly ingenious nature. It is driven by a squirrel-cage induction motor, or alternatively by a compound-wound direct current motor of ¼ h.p., which runs at a speed of 1,425 r.p.m. The motor is mounted on a cast iron bracket that slides up and down a vertical steel column, and the drill chuck is attached to an extension of the motor armature spindle. The height of the chuck above the base is controlled vertically by an operating handle that moves the complete motor and drill chuck up and down the supporting column against the action of a substantial coil spring, which gives good balance and easy operation. The drill chuck can accommodate drills up to ¼ in. diameter, and the height of the chuck from the base is adjustable up to a maximum of 8 in. The machine will handle work up to 8 in. diameter circles.

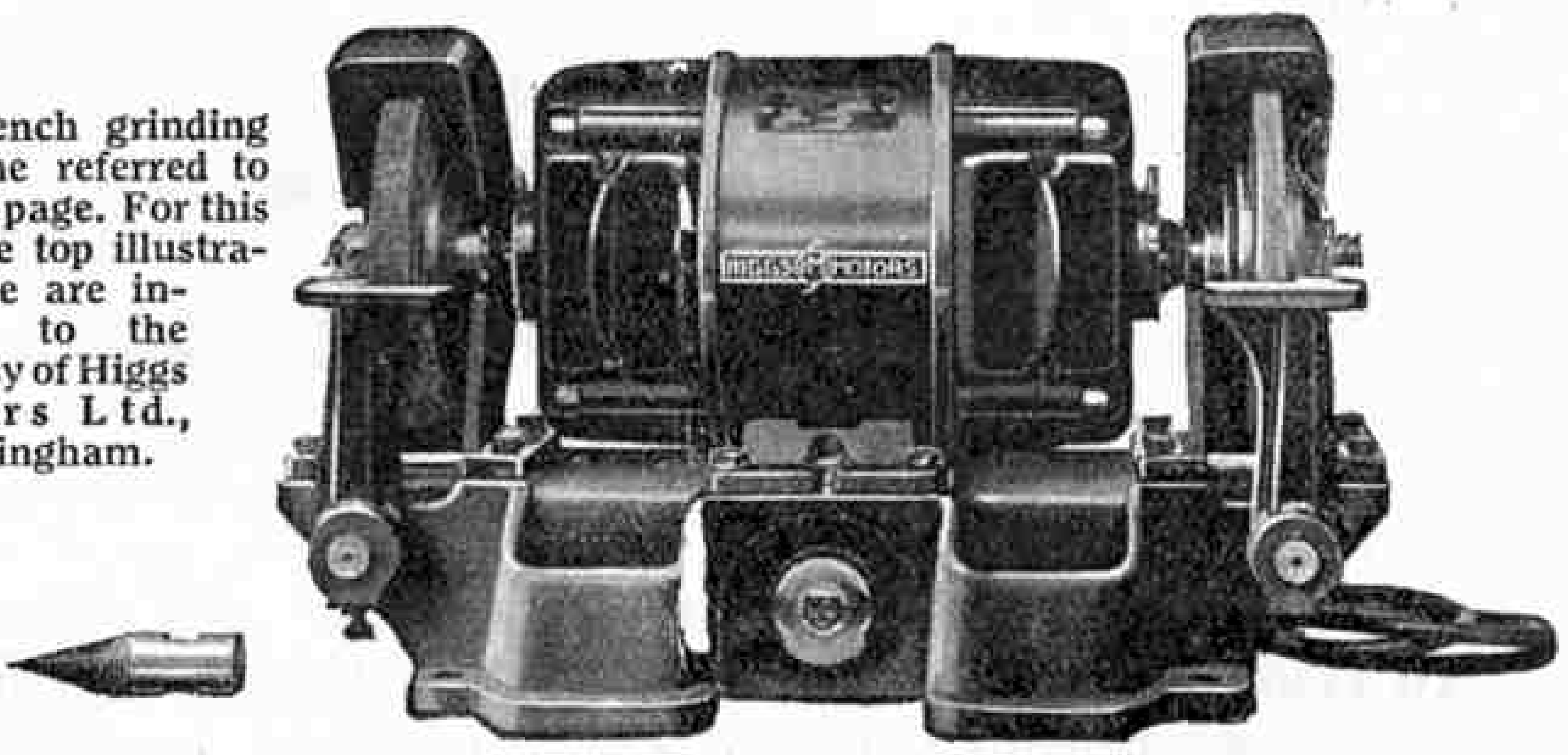
An electric automatic Vitrifier in action polishing the bodywork of a motor car. Photograph by courtesy of Black and Decker Ltd., Slough.

The bench grinder shown in the illustration at the foot of the page is an ideal machine for sharpening small tools such as drills, scrapers and chisels. It consists essentially of a totally enclosed ½ h.p. electric motor that runs at a speed of 2,800 r.p.m. and is mounted on a substantial cast iron base. The base carries also guards for the grinding wheels, adjustable work rests, on which the tools are held during grinding, and also two pots, to hold water for cooling the tools while grinding. On each end of the motor armature shaft, which is machined and ground from high quality tensile steel, is fitted a grinding wheel. For this purpose each end of the shaft is provided with strong clamping plates and right-hand and left-hand screwed nuts.

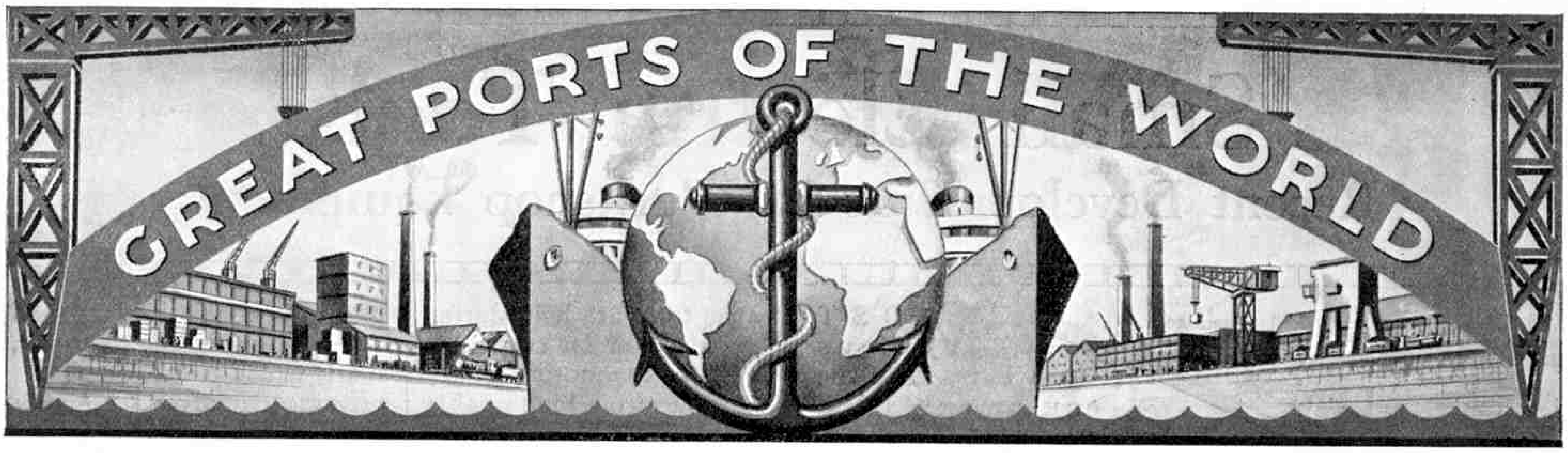
The grinding wheels are each 7 in. in diameter, one wheel being ½ in. wide and made of fine grit, while the other is ¾ in. wide and is made of coarse grit. For grinding very hard materials the fine grit wheel is used and the coarse grit is intended for rough work in softer materials. One end of the shaft is so arranged that metal polishing mops can be screwed to it without removing the grinding wheel.

The centre illustration shows an electrical device of a different type. This is a portable electric automatic Vitrifier manufactured by Black and Decker Ltd., Slough, and is used in many large motor garages for cleaning and polishing the bodywork of motor vehicles in one operation. With its aid the original colour and lustre of dirty cars are easily restored, and films of dirt that cannot be removed satisfactorily by washing are quickly eliminated, while a durable finish claimed to be unequalled even with many hours of tedious hand rubbing is provided. In addition to its use on road vehicles, the apparatus has a wide field of application in other directions, such as in furniture factories and boat-building works.

As in the case of the other small tools already described, the Vitrifier is provided with a self-contained electric motor and this is used to rotate at a speed of 1,200 r.p.m. a special cleaning and polishing pad made of lambswool. The device is provided with a reservoir to hold the necessary polishing wax, which is applied to the pad simply by pressing a plunger fitted in a convenient position near the handle of the machine, The motor unit and polishing head is attached to a specially designed interchangeable handle.

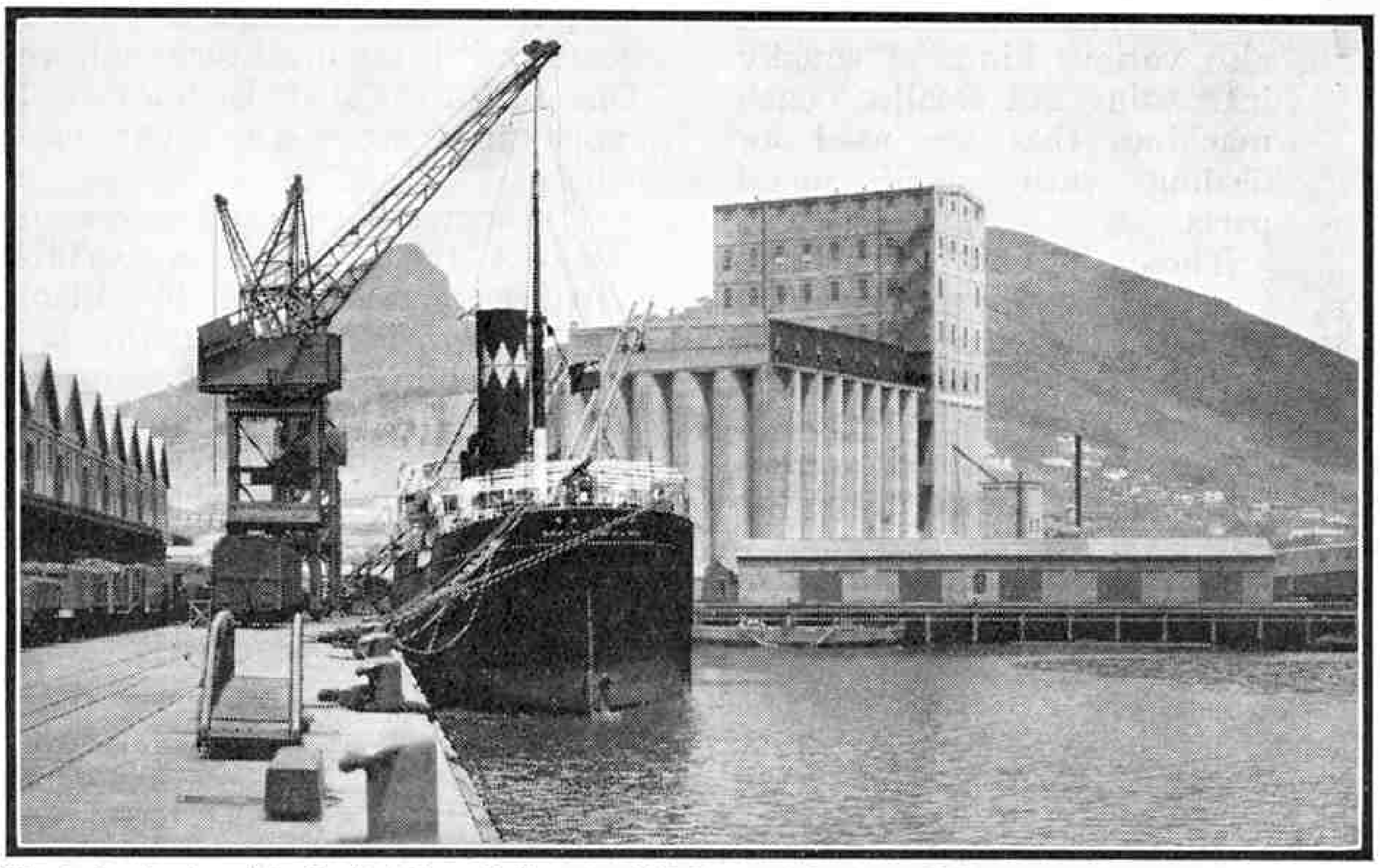


The bench grinding machine referred to on this page. For this and the top illustration we are indebted to the courtesy of Higgs Motors Ltd., Birmingham.


GREAT PORTS OF THE WORLD

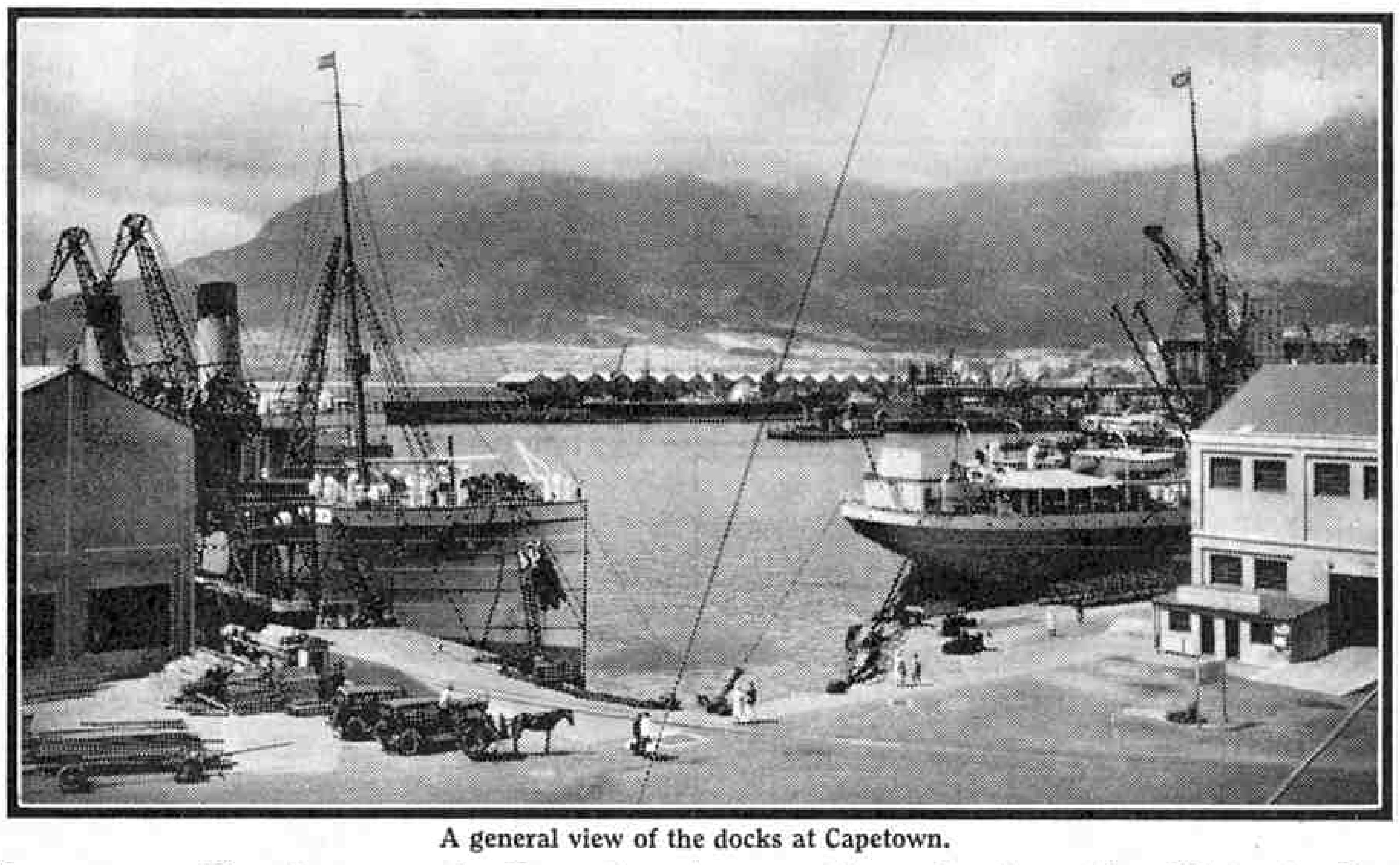
XVII.—CAPETOWN

CAPETOWN has the distinction of being the oldest town in South Africa. It was founded in 1652 by colonists of the Dutch East India Company, who had long realised that the Cape of Good Hope would make an ideal port of call at which their ships on the way to and from the East Indies could take in water and provisions.



The grain elevator of the South African Railways and Harbours at Capetown. It has a capacity of 30,000 tons. The illustrations to this article are reproduced by courtesy of the High Commissioner for the Union of South Africa, London.

The settlers found the country inhabited by a people named Quaequae, whom they renamed Hottentots. At first the settlement consisted only of a few houses under the shelter of a fort at the mouth of the Zoeta or "Sweet Stream," and the land occupied by the colonists was only a few square miles in extent. They had many difficulties and hardships to endure, but by reducing the Hottentots to serfdom or compelling them to retreat farther inland they gradually extended the colony. Other European colonists joined the pioneers, and by the close of the 17th century the population of Capetown included, in addition to the original Dutch, large numbers of Germans, Flemings and French.

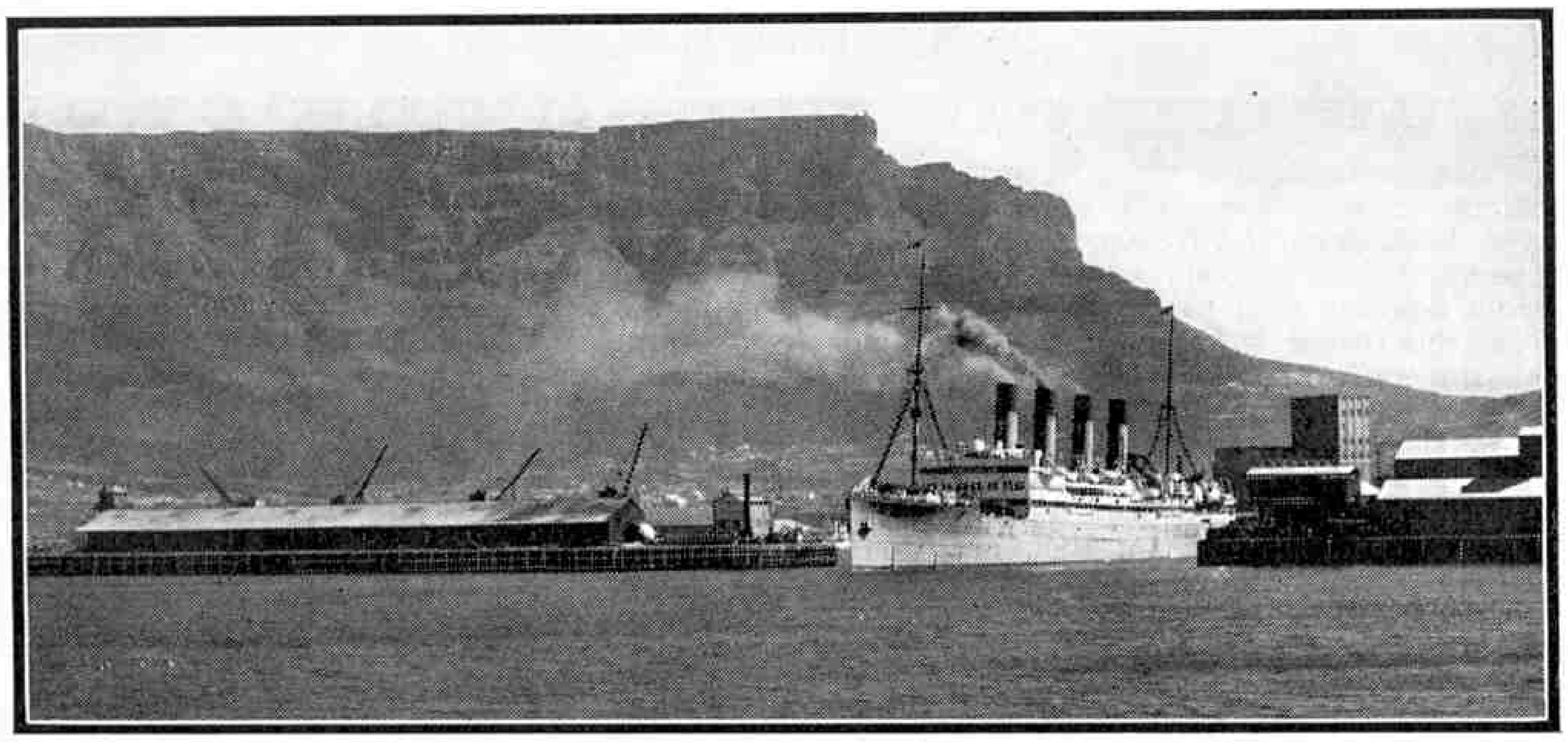


A general view of the docks at Capetown.

In 1795 the colonists rebelled against Dutch rule, and a fleet was sent from England to support the authority of the Prince of Orange, and it took possession of Cape Colony in his name. The colony was restored to Holland at the Peace of Amiens in 1802, but when war broke out again four years later it was retaken by the British; eventually it was ceded to them by the King of the Netherlands, and it has remained a British possession.

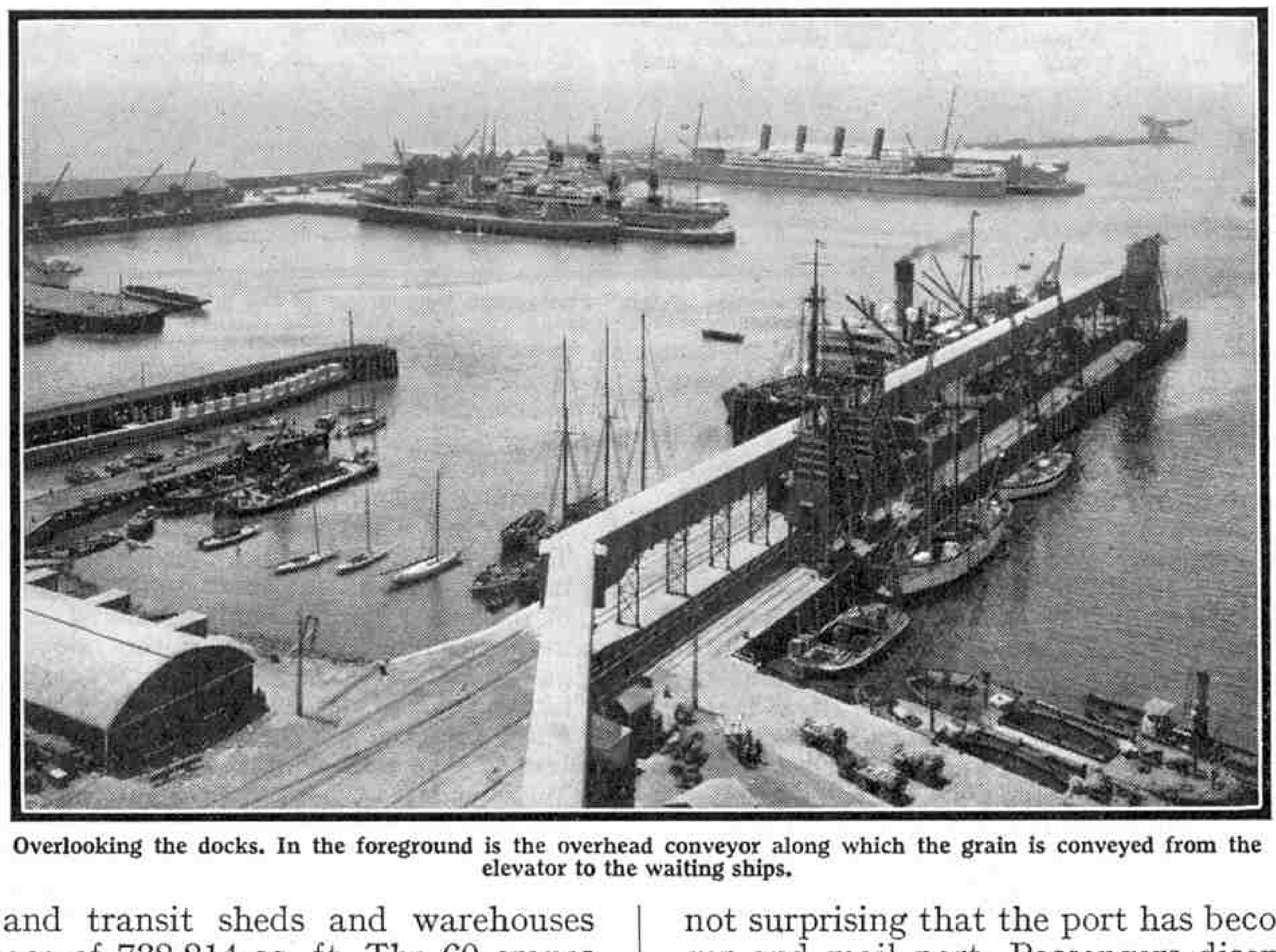
Capetown continued to increase in size and population, and attention was paid also to its development as a port. There had been primitive facilities since 1656 for dealing with cargoes, but not many ships visited the town, as the harbour was a very unsafe anchorage owing to being exposed to the north and north-west gales of winter. A breakwater was essential to remedy this state of affairs, and the construction of one was begun about 1860. The work progressed in stages, and by 1905 the breakwater had reached a length of just over 3,000 ft. The original completed structure was 3,640 ft. in length, but was further extended to 4,889 ft. during April, 1934. There are three basins, the Victoria Basin, the Alfred Basin and the New Basin, of 67, 8½ and 196 acres respectively. The quays and jetties of the three basins are equipped with cranes of three tons and four tons capacity.

The port was administered by its own Harbour Board until 1910, when the Union of South Africa was formed. It was then placed under the administration of a body known as the South African Railways and Harbours, which is under the control of the Minister of Railways and Harbours. In 1924 a grain elevator of 30,000 tons capacity was put into service. It embodies the most up-to-date devices for the efficient handling of maize in bulk, and can receive and discharge the grain at the rate of 1,000 tons per hour. Overhead conveyors enable the grain to be shipped from the elevator direct into the hold of ships berthed at No. 4 jetty, at the Alfred Basin.



The Union-Castle liner "Windsor Castle" outward bound from Capetown. Table Mountain forms an impressive background.

It was decided to create a second large dock, adjoining the Victoria Basin, by building a long mole to the east of, and parallel with, the South Arm, and this important work was begun in 1924. The South Arm is also being widened by the construction of a new quay wall alongside it to provide accommodation for some of the cranes and warehouses of the new basin. The new dock created by these constructional works will have a water area of 196 acres, more than double that of the Victoria Basin. Early this year work was begun on the building and equipping of a deep-water quay 900 ft. in length, in the new basin, so that the port will be able to accommodate the 25,000-ton liners now being built for the Union-Castle Line.



Overlooking the docks. In the foreground is the overhead conveyor along which the grain is conveyed from the elevator to the waiting ships.

The docks equipment of the port includes a total length of 2½ miles of quayage, and transit sheds and warehouses with a total floor space of 738,814 sq. ft. The 60 cranes range in lifting capacity from 3 to 15 tons, and there is a floating crane with a lifting capacity of 60 tons at 80 ft. radius.

The commerce of the port is considerable, and during the year ended 31st March, 1934, imports totalled 915,921 tons and exports 381,206 tons. The chief imports are timber, building materials, and railway materials ranging from sleepers to fully built locomotives. Large quantities of oil fuel are imported to the numerous privately-owned oil storage tanks at the docks; these tanks have a total capacity of 23,500 tons, and are equipped with pumping plant and pipelines to the quays. There are also 13 petrol storage tanks and eight paraffin storage tanks, the total capacity of these plants being 16,926,670 gallons. Another important commodity imported is whale guano, which is brought to Capetown from Saldanha and conveyed to the hinterland or transhipped to other countries.

The export trade of the port includes fruit of many kinds, grain, wool, skins and hides, asbestos and dairy produce. The fruit is brought to Capetown from all parts of South Africa, in specially constructed refrigerator vans. On arrival at the docks it is transferred to the chambers of a modern pre-cooling store at East Pier Berth, No. 8 Quay, where experts examine and grade it prior to shipment. It is dealt with almost entirely by ingenious electrical plant so that human handling of it is reduced to a minimum. Overhead conveyors transport the fruit direct from the store to the holds of ships berthed at the quay or at the adjoining No. 7 Quay.

Capetown is also the chief port for the export of gold and diamonds from the Witwatersrand district. The South African fish-canning industry exports most of its products from this port, and the bulk of them are shipped to Australia.

South Africa possesses many scenic wonders, and as the railway from Capetown penetrates far into the heart of the country it is not surprising that the port has become the chief passenger and mail port. Passengers disembark to find trains waiting alongside the liners to convey them safely to Johannesburg, 956 miles away or to Rhodesia, or to Durban, 1,253 miles distant.

We are indebted to the courtesy of South African Railways and Harbours for the 1934 trade figures in this article, and to the High Commissioner for the Union of South Africa, London, for the remaining information.

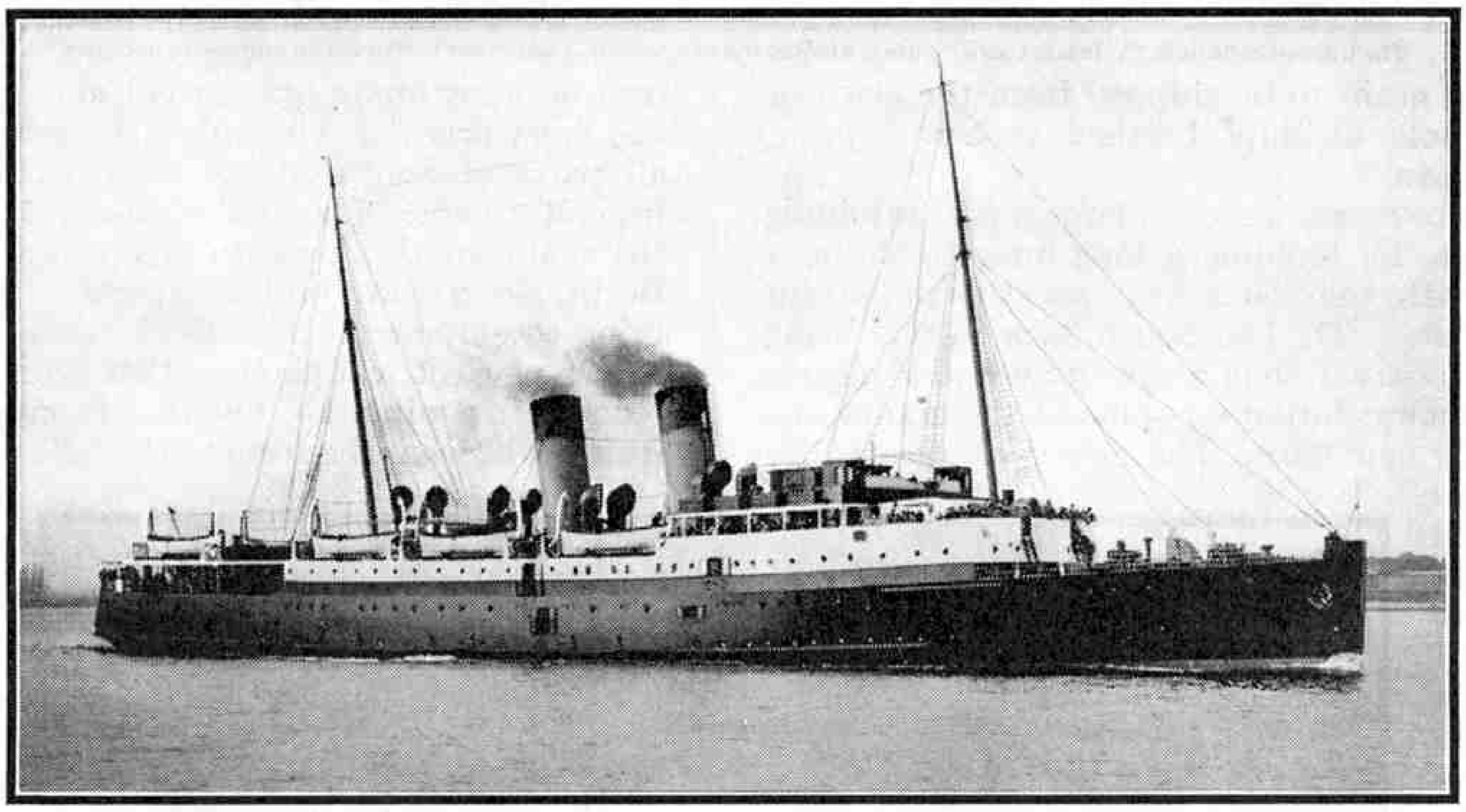
Southampton to Havre by "St. Briac"

The Fascination of a Crossing in Moonlight

By O. S. Nock, B.Sc., D.I.C.

THE Southern Railway operate, in connection with the French railways, four distinct services between London and Paris. Those routed via Dover, Folkestone and Newhaven involve comparatively short sea passages and are very popular with people travelling by day. From Southampton to Havre, however, is a seven-hour trip, and for this reason it has become the principal night service; in both directions the boat leaves shortly after 11 p.m., thus giving passengers a long night's rest. The journey itself is by far and away the most interesting of all the English Channel crossings.

When making the outward and return trips recently I was fortunate enough to travel on two nights of the most perfect weather imaginable, when a brilliant full moon and excellent visibility rendered the passing scene almost as clear as day. I boarded the "*St. Briac*" in the Outer Dock at Southampton shortly after 9 p.m. At that time the dock was a very placid scene. The "*Isle of Guernsey*," bound for the Channel Islands, was berthed just astern, while a number of other Southern Railway ships were moored near by. Although in darkness except for their riding lights, almost every detail of them was reflected in the still water, so brilliant was the night.



The cross-channel turbine-driven steamer "St. Briac." Photograph by courtesy of the Southern Railway.

The "*St. Briac*," and her sister ship the "*Dinard*," are the largest of the Southern Railway fleet based at Southampton. They have a displacement of 2,290 tons, a length of 325 ft., and an average draught of 12¼ ft. They are turbine driven and have a speed of 19½ knots.

Real bustle began with the arrival of the boat train from London, and half an hour later, on the stroke of 11.15 p.m., we were under way. Some skilful manœuvring is necessary to get out of this dock, for the space is very confined. A rope from one of the bow donkey engines was attached to a buoy. Directly we started away the donkey engine was set going, and by pulling in this rope the bow of the ship was gradually drawn away from the quay, and we described a narrow circle round the buoy. As soon as the bow was pointing towards the dock entrance, the rope was unhitched by some men in a rowing boat, we passed slowly out, and so into the River Itchen. Another very sharp turn is necessary before we are heading downstream, and in adverse conditions of wind and tide a rope is often needed to pull the ship round. A rowing boat is always in attendance here ready to take the rope and make it fast to the river bank, but to-night, however, on an ebb tide, no assistance was necessary.

By the time I joined Captain Golding on the bridge, we were gliding smoothly down the river without the slightest tremor from the engines. Some big liners were berthed alongside the Itchen quays. We passed quite close to the well-known Blue Star line cruising ship "*Arandora Star*," while near by was one of the older vessels of the Union Castle line, the "*Edinburgh Castle*." In the background could be seen the towering funnels of the Cunard White Star liner "*Majestic*," which was berthed in the Ocean Dock, and by now we were swinging round south-east into Southampton Water.

The Captain, in a quiet, almost conversational voice, gave the course "South-east by south, three-quarters south." "South-east by south, three-quarters south," echoed the husky voice of the helmsman. A turn or two of the wheel, and then a moment later he reported: "South-east by south, three-quarters south, Sir." "Alright." The ship was on her course. For the next one-and-a-half hours, while we were working our way down to the Solent and through Spithead, the direction was changed frequently, each time with the same sort of exchanges.

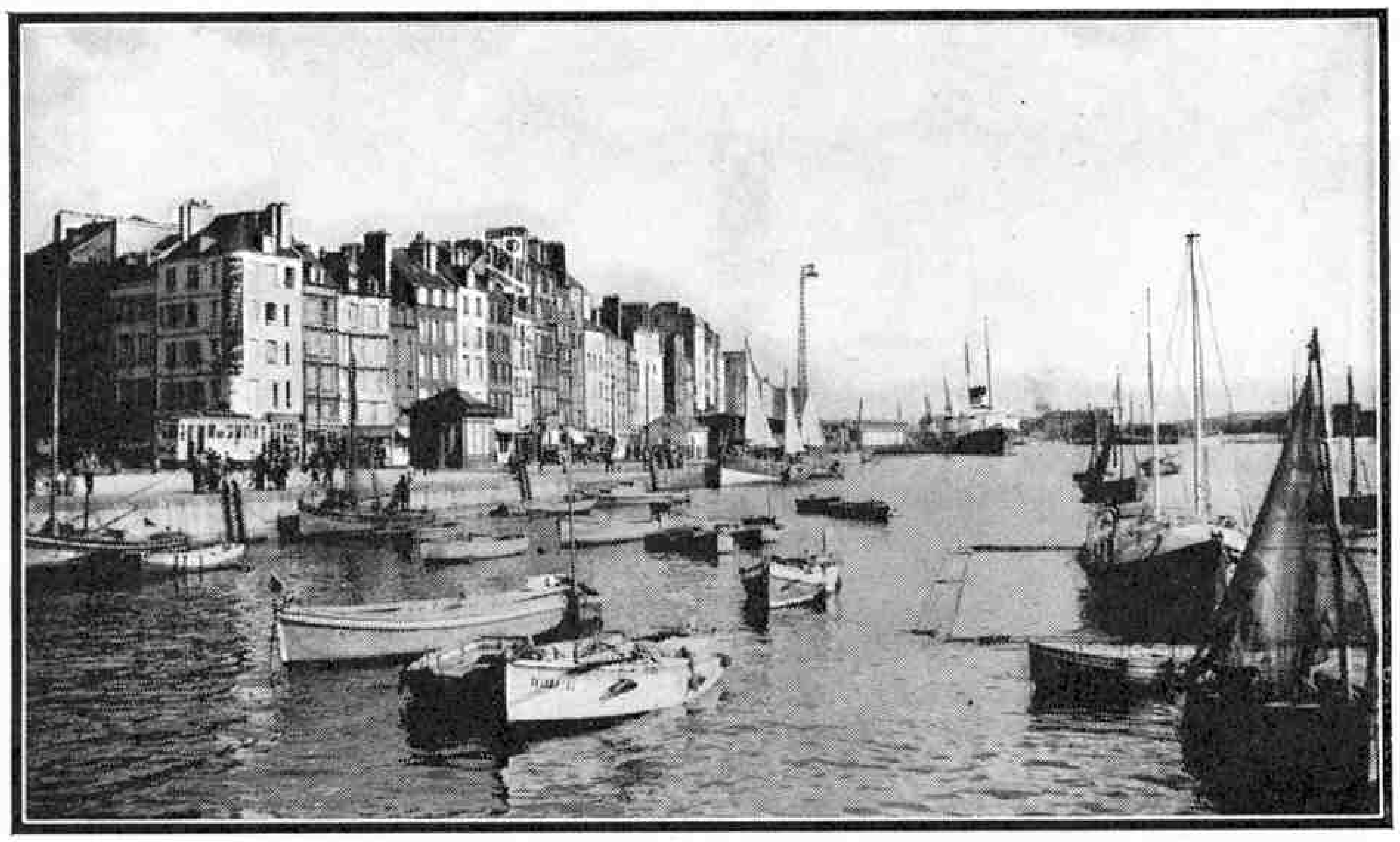
The little township of Hythe slipped by. A big oil refinery showed up as a blaze of lights on the right bank; here is a specially equipped jetty where the tankers discharge their freight. A few scattered lights on our port bow showed the whereabouts of Netley, and soon we were approaching Calshot seaplane station. Quite a score of machines were moored in the shelter of the narrow spit of land that runs out from the shore, and their graceful forms rising and falling on the swell, their riding lights, and the dancing moonbeams on the water made a most beautiful spectacle.

Now our course lay towards Spithead, to the left of the Bramble Bank. At extremes of tide, such as at the Spring and Autumn equinoxes, this is left as a dry sandbank at low water. On the course we were now taking there is never enough depth of water for the big liners, and they steam up Cowes Roads and make an S-curve round the western end of the bank and so past Calshot Spit. This is at all times an awkward piece of navigation, and in rough weather they are assisted by tugs. Even on a quiet day a sudden squall may blow a vessel out of its course, and not many months ago the "*Aquitania*" ran aground here.

With a chain of winking gas buoys marking the course, we steamed mid-way between the Isle of Wight and the mainland. Except for a few isolated lights, Cowes was in complete darkness. The spire of Ryde church showed against the skyline, and the moonlight glinted on some of the housetops; but on the other side of the water Portsmouth shimmered in a myriad lights. A flashing more brilliant than that of the buoys revealed one of the forts guarding Portsmouth harbour. There are three of these pill-box like erections between Southsea and the Isle of Wight, and the two outer ones, the Noman Fort and Horse Fort, each carry a revolving beacon. We passed quite close to the latter, flashing our name in Morse code to the Lloyd's signal station situated on the fort. This was just for identification purposes, though as the Captain laconically remarked: "They know us alright by the time. We're so regular they could quite well set their watches by us."

More powerful lights lay ahead. First we came to the Warner Lightship, which has a very slow revolving light, and then far ahead was the Nab Tower. This for all practical purposes is a lighthouse, though in the form of a cylindrical steel tower. It has a most interesting history. During the War, when German submarines were causing such serious losses to merchant shipping as to place our food supplies in the utmost jeopardy, Sir Roger Keyes, the Commander-in-Chief at Dover, prepared a scheme for closing the Straits to enemy craft by a complex barrage. A series of deep minefields were to be laid, and from two high towers the waters were to be swept incessantly with searchlights. To avoid detection submarines would be forced to dive, to almost inevitable destruction in the minefields.

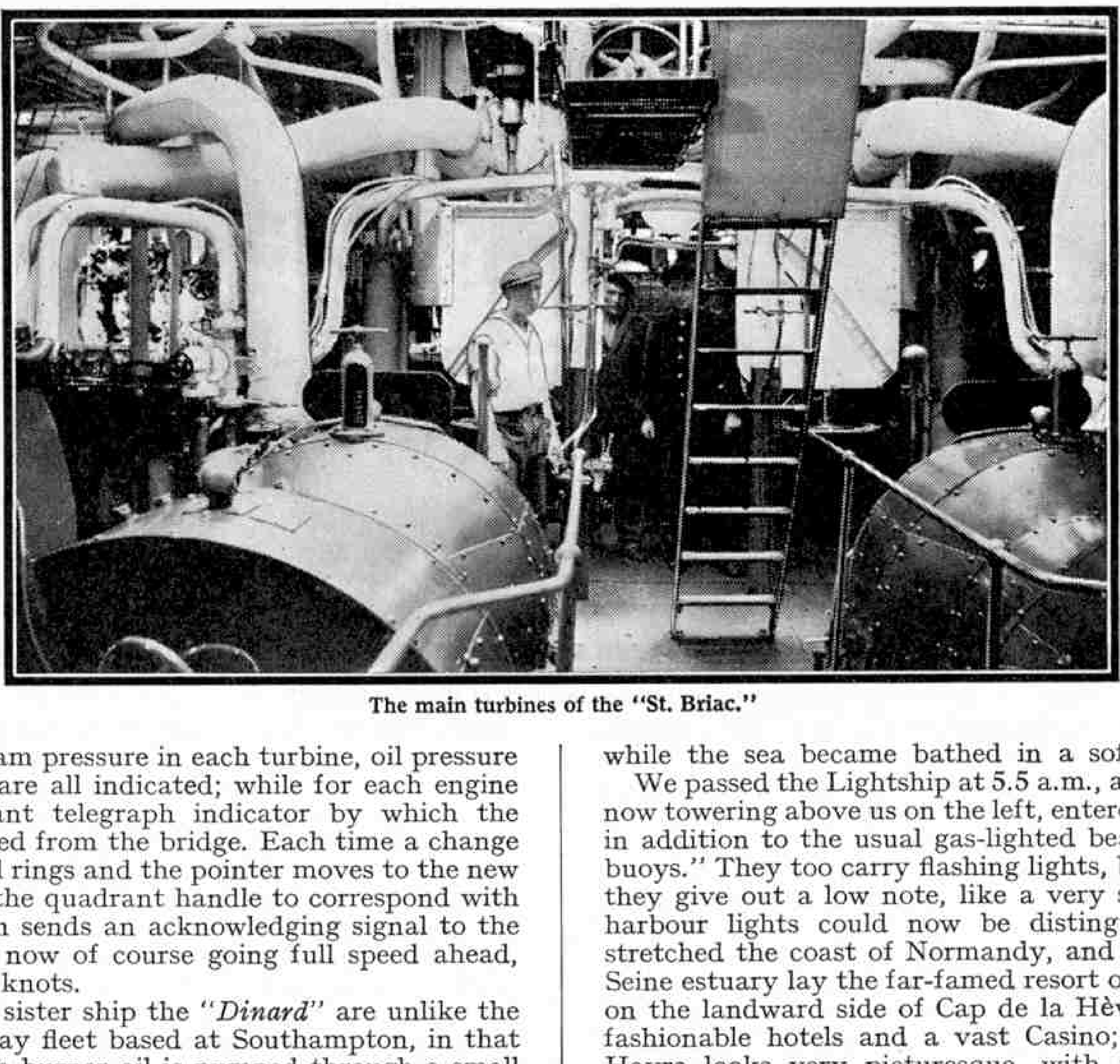
The end of the War came before the scheme was complete, but one of the towers was nearly finished and the Admiralty decided to use it at Spithead in the place of an old lightship. It thus became the Nab Tower. Its usefulness is being still further enhanced at the present moment by the installation of a radio beacon. This will be of great value for enabling ships to take their bearings by wireless in bad weather, for powerful though the light is, its range can be limited to a few hundred yards in fog.


The harbour and waterfront, Havre.

We passed the Nab Tower at 12.50 a.m., and here turned due south across the Channel. The low Sussex coastline vanished into the pervading greyish-blue of sky and sea, and away to the west the high Culver cliff was humped up against the sky. Then there developed the strangely beautiful sight of a lighthouse whose direct beams are obscured. The big light at St. Catherine's Point shines out far across the Channel, but coming out of Spithead it is seen from behind, and the beam sweeps across the sky like a great fan. Brighter and brighter grew the nodal point, until suddenly, when we passed clear of the intervening headland, the beam came straight at us in a vivid imperious stab of yellow light.

* * * * *

The atmosphere of the engine room, hot and damp with steam, is rather like that of the footplate of an express engine. There is the same strong smell of hot oil, but instead of the incessant racket of a locomotive, there is only a deep-toned purr from the turbines, and the merest suspicion of vibration. Standing on the control platform one gets a fine impression of the power plant as a whole. The highest efficiency is obtained from a steam turbine when running at a high speed, and in this ship they make 2,800 r.p.m. when running at full speed, each developing 2,750 h.p. On the other hand, a propeller is most efficient when running at a moderate speed; and so a reduction gear of about 11 to 1 is used to give a propeller-shaft speed of 250 r.p.m. Looking aft, the starboard turbine is on the left and the port turbine on the right; both are completely encased, in fact the only moving machinery visible is the oil pumps.


The main turbines of the "St. Briac."

The control platform is one great array of gauges. Boiler pressure, steam pressure in each turbine, oil pressure in the lubrication system, are all indicated; while for each engine there is the usual quadrant telegraph indicator by which the Captain's orders are signalled from the bridge. Each time a change in speed is required, the bell rings and the pointer moves to the new position; the engineers set the quadrant handle to correspond with the pointer, and this action sends an acknowledging signal to the bridge. Both engines were now of course going full speed ahead, and we were making 19½ knots.

The *"St. Briac"* and her sister ship the *"Dinard"* are unlike the rest of the Southern Railway fleet based at Southampton, in that they are oil fired. Into each burner oil is pumped through a small nozzle, the orifice of which is not much bigger than a pinhole; this vaporises the oil and it ignites spontaneously on entering the burner. To produce sufficiently rapid steaming it is necessary to use forced draught, which is provided by a fan placed at the level of the boat deck. A strong upward current of air through the stokehold is created, and in addition to providing the draught it makes the atmosphere in which the firemen work a good deal less oppressive than might at first be imagined. Even when standing right in front of the furnaces you can feel the cool stream of air. To confine the draught to the stokehold, the latter compartment is shut off from the engine room by means of an air-lock. When passing through you enter the air-lock, and close the door behind you before opening the exit door. If both doors were open at once, a miniature whirlwind would be created.

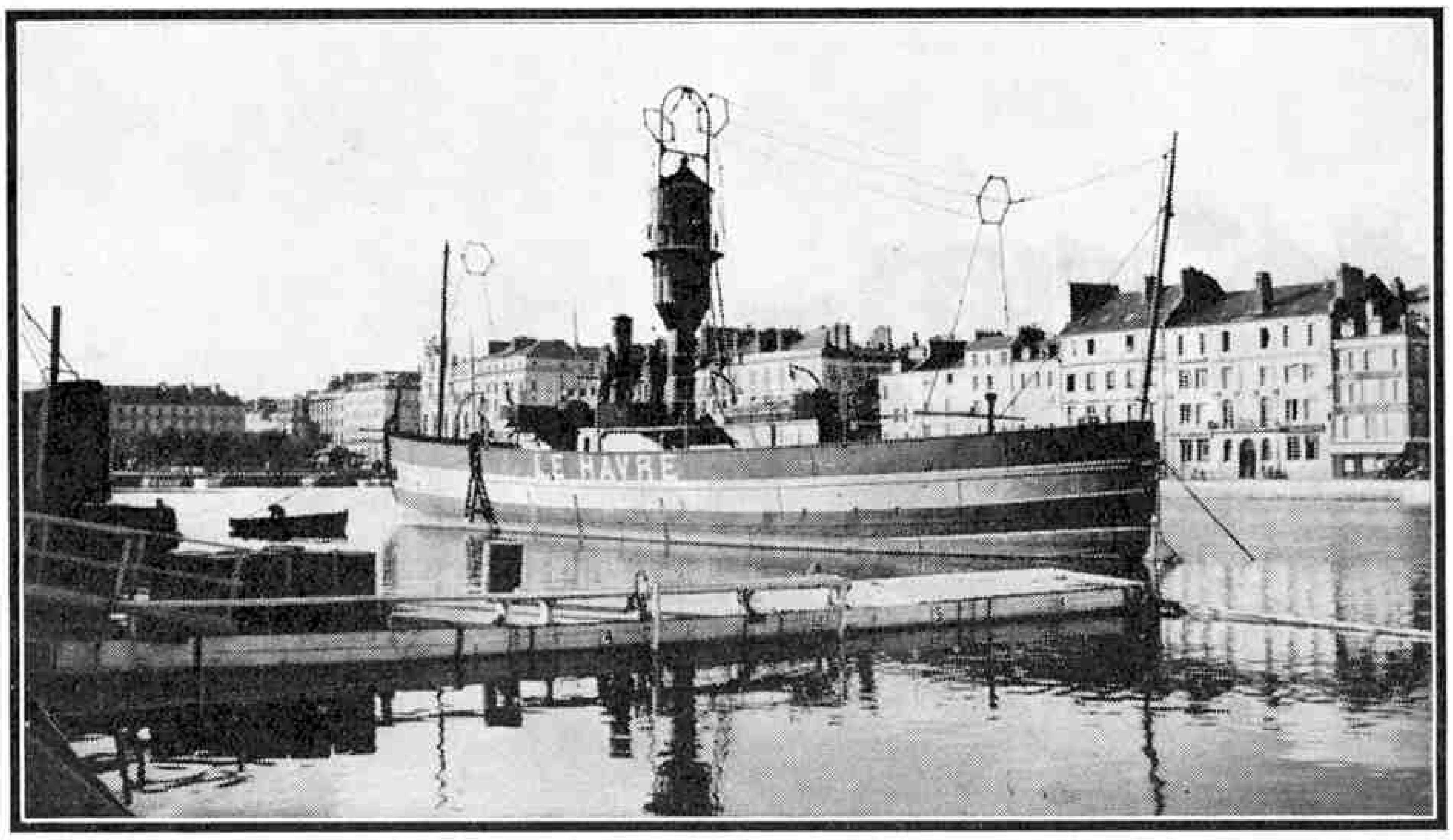
It was nearly 2 a.m. when I came up on deck again. It was a magic night. The gentlest of breezes was blowing from the north, and except for a distant line of silvery cumulus on the southern horizon the sky was cloudless. The moon threw a soft bluish-grey light over the whole scene, and the flashes of St. Catherine's Point lighthouse grew fainter until they became mere pin-points.

I turned in for three hours while we were in mid-Channel, but at 4.45 a.m. I was again on the bridge. The French coast is magnificently lighted, and now four great lighthouses were flashing ahead. Although it was still very calm, a considerable change had occurred in the weather; a great bank of cloud was piled up to the south, while the sinking Moon showed up drifting rainstorms in the direction of Cherbourg. Low in the south-eastern sky hung the planet Venus, almost as brilliant as the French lighthouses.

Already the lights of Havre were showing up in a faint twinkling line, the striking bluff of Cap de la Hève was revealed against the skyline, and we were rapidly nearing the Havre Lightship, a flashing red light. Everyone has seen in the splendours of sunset what John Oxenham has called "the matchless pageant of the evening skies"; but the wistful beauty of daybreak has perhaps an even stronger appeal. This morning, seen from the Bridge, it was exquisite. I watched dawn ride across the heavens from the east, the stars pale overhead, and all the patches of clear sky change to a warm orange colour near the horizon, while the sea became bathed in a soft pale yellow iridescence.

We passed the Lightship at 5.5 a.m., and with La Hève lighthouse now towering above us on the left, entered the Havre channel. Here, in addition to the usual gas-lighted beacons, are several "whistle-buoys." They too carry flashing lights, but as they rise on the swell they give out a low note, like a very soft and musical siren. The harbour lights could now be distinguished; away to the west stretched the coast of Normandy, and on the opposite side of the Seine estuary lay the far-famed resort of Deauville. Under the cliffs on the landward side of Cap de la Hève in a fine esplanade, with fashionable hotels and a vast Casino; from the sea this part of Havre looks very picturesque, with many houses built up the wooded hillside.

As we neared the harbour entrance speed was reduced to half; there was a fine view of the quays from which the Transatlantic liners sail, and we were swung round into the old harbour. The water was alive with small craft. Alongside the quay were anchored a number of those brightly-coloured fishing boats that look so distinctive when they put in at Cornish harbours; their hulls were painted a pale green, and to this vivid colouring were added the bright blues and mauves of the fishermen's overalls. The waterfront is a long line of old houses, of every shape and height, but all having those shuttered windows so characteristic of the Continent. On the opposite side of the harbour, high above a forest of masts and funnels, was the big French liner *"Ile de France."*


One of the Havre Lightships. This is kept in reserve and is identical with that anchored off Cap de la Hève.

We edged in towards the quay, where a crowd of excited, gesticulating porters were waiting, and where two sleepy-looking gendarme lounged at the Customs entrance. It was 6.5 a.m. when we berthed, and a few moments later most of our passengers were hurrying for the Paris "Rapide." Two through coaches and the restaurant car were waiting at the quayside; these are hauled through the streets up to the principal town station by a big tank engine, and there attached to the express proper. The journey is made over the metals of the French State Railway, Chemin de fer d'Etat, and Paris, St. Lazare, is reached at 9.49 a.m.

I spent a most interesting morning exploring the Havre docks, which in recent years have been greatly extended. The Transatlantic berths are so designed that the largest ships can very quickly get away under their own power. Such a giant as the *"Normandie,"* which regularly sails from Havre, is only assisted by tugs for the first few minutes while getting off the quayside. Along the Seine cargo docks stretch for miles southward, but most picturesque is the Yacht Dock, which extends into the very heart of the town. Along the quays are many stately buildings mingled with groups of very quaint old tenement dwellings, while at the head of the dock are some beautiful gardens.

All sorts and conditions of ships were to be seen, from steam yachts and sailing schooners to harbour pilot boats, but perhaps the most interesting was one of the Havre lightships. There are two of these vessels, one doing duty off Cap de la Hève and the other in reserve. Painted in maroon and black, and lined out in white, they are of most striking appearance as well as being extremely efficient as beacons.

Havre by night from the deck of the "St. Briac."

* * * *

Evening in Havre. There is ceaseless activity in the harbour. Tugs and pilot boats are constantly coming and going; a big Brazilian ship is preparing to leave, with four tugs ready to assist her out of dock; a tramp steamer comes chugging out of the inner harbour. The French maritime authorities have standardised an interesting system of harbour signals, and watching from the deck of the *"St. Briac"* their rapid changes almost suggested the flow of traffic at a busy railway terminus. Four lamps are placed vertically above one another on a tall mast; three green lights indicate that the harbour is open to inward but closed to outward traffic, while three red lights mean the reverse. If a white light appears above either of these signals, it means that the tide is favourable for an immediate entry or exit from the docks. The remaining signal that is displayed is two red lights with a green between them; this indicates that the harbour is closed to all traffic, in either direction.

Just after 10.30 p.m. a deep siren blast from the Transatlantic docks heralded the departure of a big ship. There was no difficulty in recognising her Line, for the funnels were floodlighted and on a white band a brightly painted Red Star stood out. At first only the funnels were visible above the sheds along the quay side, but soon she passed clear and swept out to sea, a veritable city of light. Our departure time of 11.30 p.m. was now drawing near. The air was crisp with frost, the moon was as brilliant as ever; but Captain Golding cocked a thoughtful eye at a bank of low mist that hung over the town. "We may get fog in the morning," he remarked.

The "Rapide" from Paris heralded its approach through the streets by continual sounding of the whistle. The engine was one of the older Etat four cylinder 4–6–0 compounds, and being, like many Continental locomotives, simply smothered in pipes, feedwater heaters, and other "gadgets," presented a strikingly different appearance from modern streamlined engines. On its arrival at the quayside I went down below to watch them start up in the engine room. Boiler pressure was full up and a wisp of steam was rising from each turbine. Then, with startling suddenness, the telegraph bell rang: "Stand By!" The handles of port and starboard indicators were quickly set to correspond, thereby sending the acknowledging signal to the bridge. A few minutes of waiting with everyone on the alert, then "Slow Ahead" on both engines. The speed of the turbines is controlled by means of the steam pressure; definite figures are laid down; 5 lb. per sq. in. for "Dead Slow," 20 for "Slow," 60 for "Half," and the full 180 lb. per sq. in. of the boilers for "Full Speed." Control is effected by a regulating valve operated by what looks like an inverted motor car steering column and wheel.

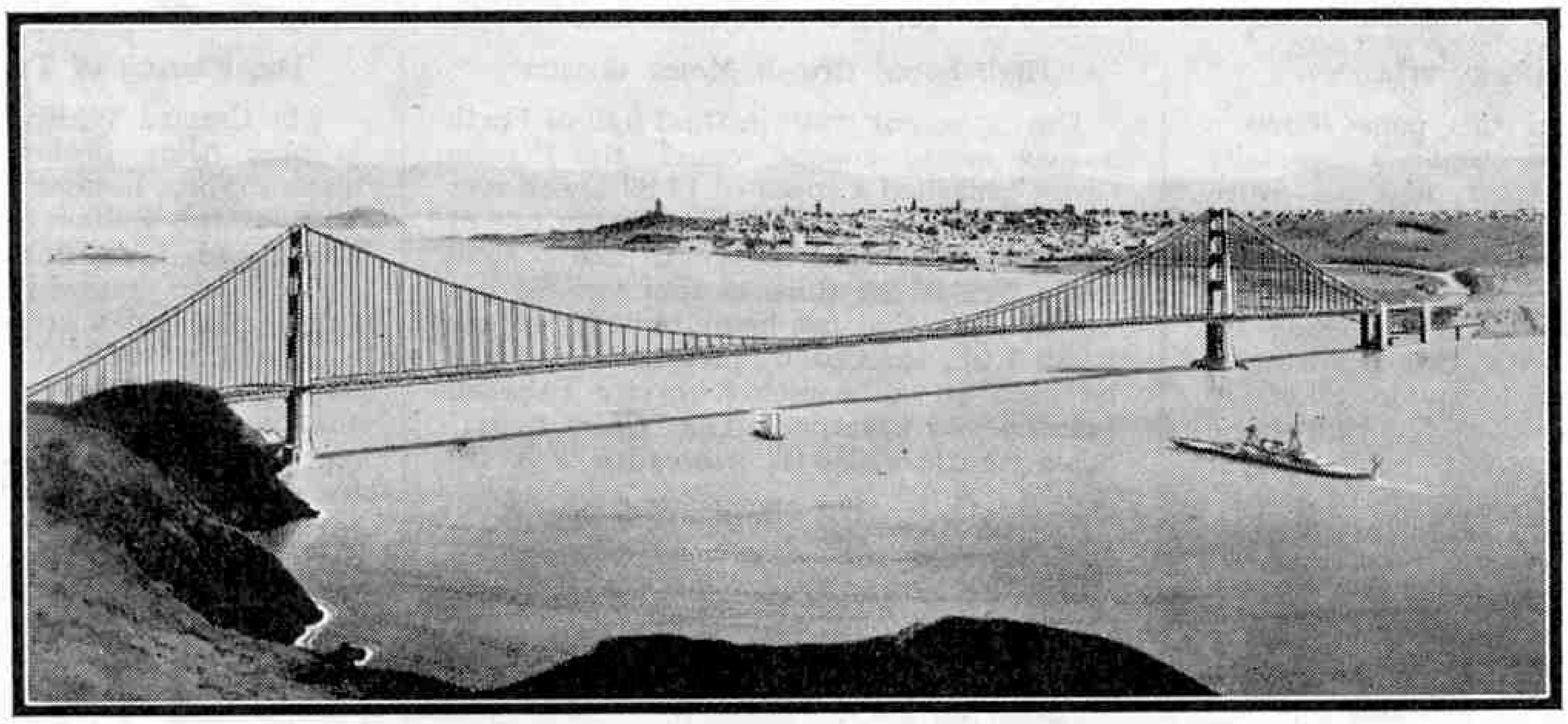
Changes in speed came rapidly while we were getting out of harbour, sometimes "Half," sometimes "Dead Slow," and often the two engines were running at different rates; but about ten minutes from the start came "Full" on both engines. "The Chief" set the regulators, and then turned to me with his usual cheery smile: "All set now for right across the Channel." I came out on deck just as we were passing Cap de la Hève; the lights of France slipped away fast, and so out into the blue.

I was awakened by repeated sounding of the siren; the expected fog had evidently come, but after 6 a.m. the steward called me with the news that we were sailing up Southampton Water dead on time. It was only a slight mist, and when I came on deck all was clear and we were just approaching Southampton. We slipped past the big ship berths and into dock to berth on the stroke of 6.30 a.m. So ended a delightful trip.

The World's Greatest Suspension Bridge

Span of 4,200 ft. to Cross the Golden Gate

SAN FRANCISCO stands at the tip of a narrow peninsula that projects northward and separates the Pacific Ocean from the southern half of San Francisco Bay. The northern half of the bay is similarly separated from the ocean by a peninsula called Marin County which projects southward to a few miles short of San Francisco. Between the two headlands is a waterway called the Golden Gate, and across this the greatest suspension bridge in the world is being built. The bridge will have a centre span 4,200 ft. in length, which will be 700 ft. longer than the centre span of the George Washington Suspension Bridge, New York.



The Golden Gate Suspension Bridge, San Francisco, as it will appear when completed. The illustrations on this page are reproduced by courtesy of the Strauss Engineering Corporation, San Francisco.

For many years a ferry service has provided the only means of communication over the 4½ miles of sea between San Francisco and Sausilito, a coastal town in the south of Marin County, but it has long been inadequate to cope with the increasing vehicular traffic.

In 1919 Joseph B. Strauss, an American bridge engineer, carried out a preliminary investigation, and concluded that a bridge across the waterway would require to have a span of about 4,000 ft., which was 2½ times longer than any span erected up to that time. He was confident that such a structure could be built, and in 1923 the California Legislature created a body called The Golden Gate Bridge and Highway District to finance and build a bridge across the waterway and to operate it on a toll basis.

During the next six years innumerable legal details held up the scheme, but they were overcome one by one. In 1929 the leading bridge engineers in the United States were invited to submit designs, and the one accepted was for a suspension bridge 6,450 ft. long, consisting of a clear span of 4,200 ft. between the two main piers, and two approach spans each of 1,125 ft. Strauss was appointed chief engineer to carry out the design.

Joseph B. Strauss, Chief Engineer of the Golden Gate Bridge.

Preliminary work was begun on 28th November 1932, and included the making of roads to the bridge site, and the erection on both shores of temporary workshops and concrete mixing plants. The actual construction of the bridge was officially commenced on 5th January 1933, when a start was made on the building of the cofferdams inside which to erect the piers for the two great towers, and on the excavations of the anchorages.

The piers are huge concrete monoliths in which reinforcing steel is embedded close to the surface. The south pier is 1,125 ft. seaward from the San Francisco shore and measures 90 ft. by 185 ft., and is one of the largest ever built. It is 144 ft. in height and weighs 130,000 tons. The north pier has a cross-section of 80 ft. by 160 ft., and is only 64 ft. in height owing to the nearness of the rock foundation to the surface of the water. It weighs 50,000 tons.

When the piers were completed work was begun on the big task of erecting the two lofty steel towers that are to carry the main cables. They are 746 ft. in height and 121 ft. wide at the base, and are the largest and highest bridge towers in the world; they contain more steel than the entire Quebec Bridge. Each tower consists of two steel posts built up of a series of rectangular cells decreasing in number from 97 at the bottom to 19 at the top, and horizontal struts and diagonal bracing firmly connect the two posts together.

The building of the massive anchorages for the bridge cables proceeded simultaneously with the work on the piers and towers. Each anchorage consists of twin three-tier anchor blocks, and the twin blocks weigh 64,000 tons and are partly embedded in rock. A total of over 260,000 cu. yd. of concrete was used in the building of the cofferdams, piers and anchorages.

Elsewhere the two main cables for the bridge are being made, and the work of raising these into position will shortly be carried out. Each of these cables is 36½ in. in diameter and 11,000 tons in weight, and consists of 61 strands each containing 452 steel wires ⅛ in. in diameter, making the enormous total of 27,572 wires in each cable. When the cables are in position they will be 7,660 ft. long between the anchorages, and at the centre of the span they will sag 470 ft. They will be capable of supporting a load of 430,000,000 lb., or 2.6 times the maximum load that the bridge will have to bear. The auxiliary cables, by which the bridge deck will be suspended from the main cables, will be 2⅞ in. in diameter and will have a maximum strength of 1,100,000 lb.

The deck of the bridge will be 90 ft. in width from centre to centre of the cables. It will have a 60 ft. wide roadway, sufficient for six lanes of traffic, flanked on each side by a sidewalk 10 ft. 6 in. wide.

The long curved approaches to the bridge will be carried on both steel and concrete viaducts of various heights from 95 ft. to 200 ft., according to the level of the ground.

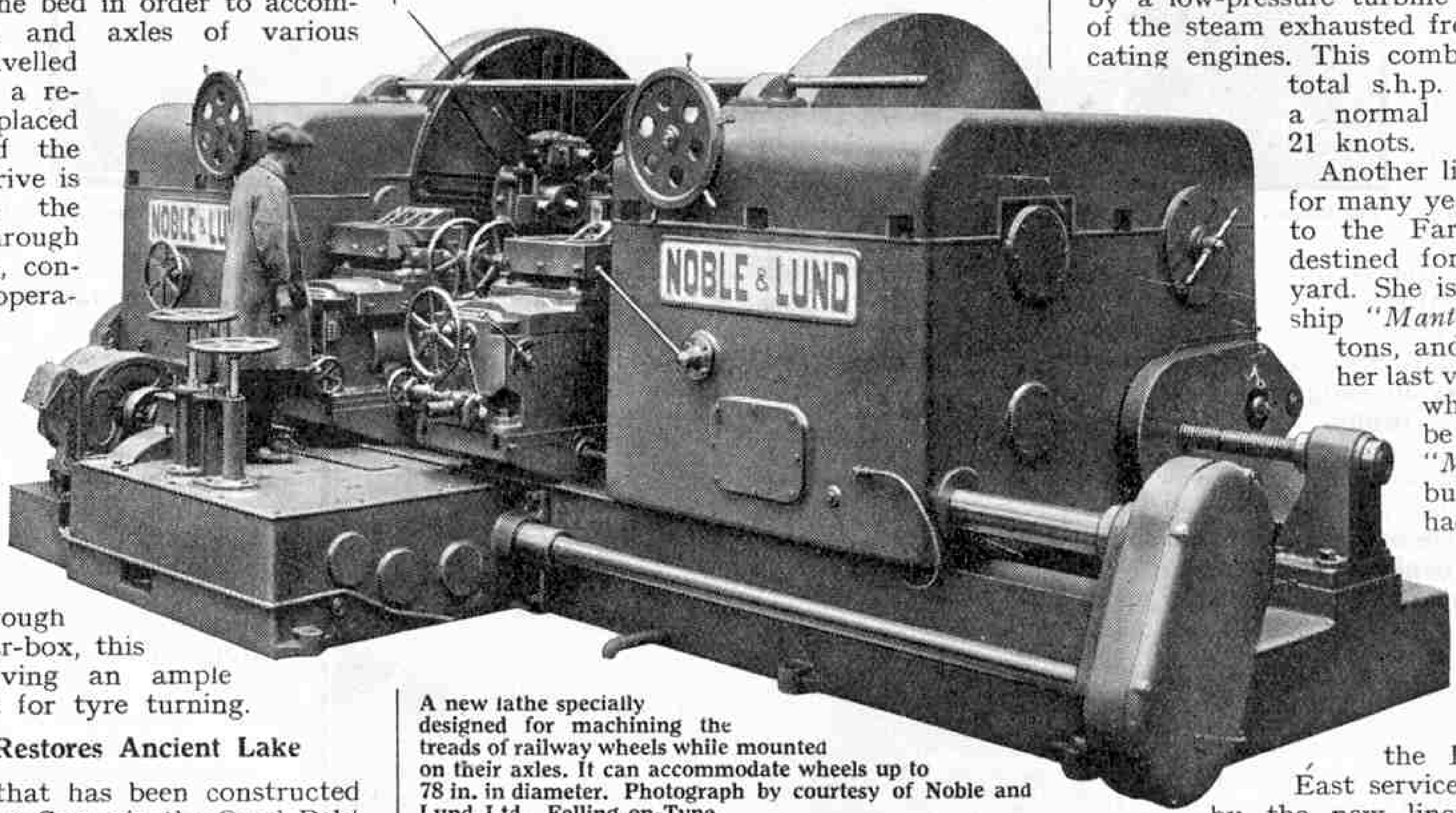
In addition to being the longest structure of its kind in the world the Golden Gate Bridge will be notable for several interesting innovations. The towers are to be floodlit and equipped with powerful aerial beacons, and the cables will be outlined in lights for their entire length. The San Francisco tower is to be surmounted by a lighthouse station, the first of its kind in the world, which will supersede the old lighthouse

It is expected that the bridge will be completed and o traffic in May 1937.

ENGINEERING NEWS

Machining Railway Wheels

The illustration on this page shows a railway wheel lathe that is specially designed to turn either new or worn railway wheels of from 36 in. to 78 in. in diameter, while mounted on their axles. The machine, which is manufactured by Noble and Lund Ltd., Felling-on-Tyne, is provided with two headstocks, each with a driven faceplate 80 in. in diameter, and two saddles. The right-hand headstock can be moved backward or forward along the bed in order to accommodate wheels and axles of various gauges and is travelled by power from a reversing motor placed at the rear of the machine. The drive is transmitted to the headstock through friction clutches, controlled from the operator's platform. The main drive is provided by a variable-speed 50 h.p. motor, the power of which is transmitted to the various mechanisms through a two-speed gear-box, this combination giving an ample range of speeds for tyre turning.



A new lathe specially designed for machining the treads of railway wheels while mounted on their axles. It can accommodate wheels up to 78 in. in diameter. Photograph by courtesy of Noble and Lund Ltd., Felling-on-Tyne.

New Dam Restores Ancient Lake

A new dam that has been constructed in the El Kansera Gorge in the Oued Beht River, Morocco, has had the effect of re-establishing an ancient lake that had become a dried-up basin owing to the fact that the river had formed a gorge into which the water of the lake drained. The construction of the dam has created a reservoir of 61 thousand million gallons capacity, which is intended for irrigating about 74,100 acres of surrounding country. As the surface of the new lake is at a level of 114 ft. above the river bed, the surplus water not required for irrigation purposes is to be utilised for driving turbines at a hydro-electric station that has been constructed below the dam.

Constructional work on the dam was carried on under the shelter of an upstream concrete cofferdam of arched form and an earth cofferdam downstream, the river water meanwhile being diverted into a concrete lined tunnel, about 11½ ft. diameter and 1,476 ft. long. This tunnel is a permanent structure, and is provided with control valves for the discharge of water to the river below the dam for irrigating purposes.

High Speed British Motor Coaster

During recent trials in the Firth of Forth a new motor coastal vessel, the *"Ocean Coast,"* reached a speed of 13.89 knots over the measured mile, which makes her one of the fastest engaged in the British coastal trade. She is the third of four vessels of a similar type that are being built by Henry Robb Ltd., for Coast Lines Ltd., and will be used on a bi-weekly service between London and Liverpool. The *"Ocean Coast"* has a length of 250 ft., a breadth of 38 ft., and a deadweight carrying capacity of 1,700 tons; and she is propelled by a twin-screw arrangement of two 750 b.h.p. "Atlas" heavy oil engines.

Included in the navigating equipment is an automatic depth recorder, and there is also a complete wireless telegraphy apparatus. In addition to large cargo holds with electrically operated lifting gear, the *"Ocean Coast"* has 12 single-berth cabins and public rooms.

A Record Rotation Speed

What is claimed to be the highest rotating speed ever achieved has been obtained with an experimental mechanism in the United States. The experiment was carried out with a very small centrifuge in which a rotor was rotated by a stream of hydrogen impinging upon a series of flutes. The rotor attained a speed of 1,200,000 r.p.m., and once it was properly running it rested entirely in a bearing of hydrogen.

The Passing of Two Famous Liners

The Cunard White Star liner *"Olympic"* is now being broken up at Jarrow-on-Tyne. This famous ship was built in 1911 at the Belfast yard of Harland and Wolff Ltd., and during her 24 years of service she crossed the Atlantic 500 times. She had a gross tonnage of 46,439, a length of 852½ ft. and a breadth of 92½ ft., and was fitted with triple screws, the outer screws being driven by reciprocating engines and the centre screw by a low-pressure turbine that made use of the steam exhausted from the reciprocating engines. This combination gave a total s.h.p. of 18,000, and a normal sea speed of 21 knots.

Another liner well known for many years to travellers to the Far East is also destined for the breaker's yard. She is the P. and O. ship *"Mantua,"* of 11,000 tons, and recently made her last voyage to Japan, where she is to be broken up. The *"Mantua"* was built in 1909 and had quadruple-expansion engines driving twin screws, giving a speed of 18½ knots. Her place in the P. and O. Far East service is to be taken by the new liner *"Strathmore,"* which was referred to in page 629 of the November, 1935 *"M.M."*

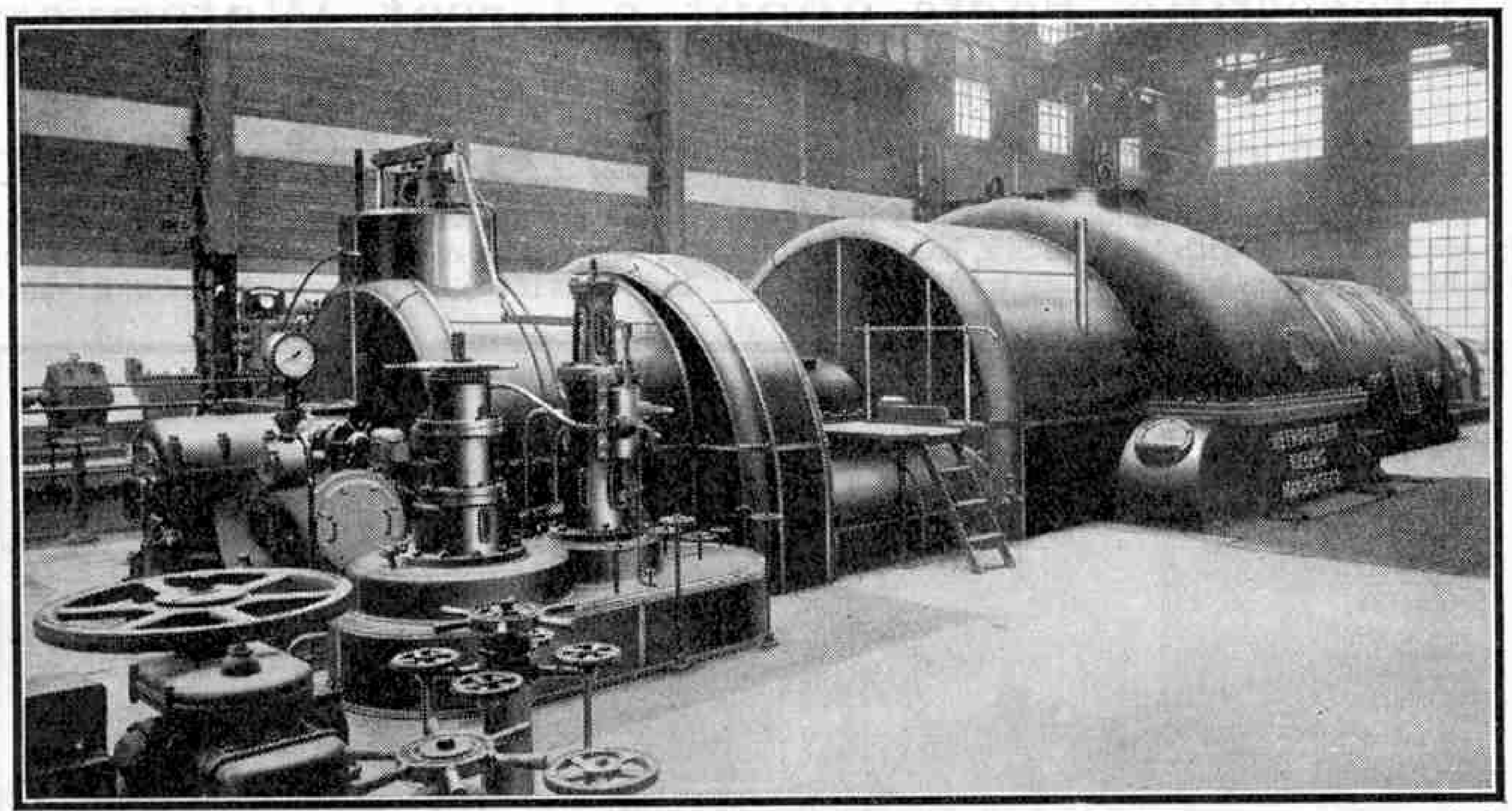
A New French Village

A new village settlement has been developed in France for the treatment of ex-soldiers suffering from tuberculosis. The village, which is about 30 miles from the nearest town, Perigueux, includes about 180 houses, a hotel for 260 persons, a central administrative building, a hospital with forty beds, and a general stores where the inhabitants can procure everything they require, from foodstuffs to furniture. There are also open-air schools, sport grounds, a theatre and a large garage.

The village possesses its own electricity station, which is equipped with seven Sulzer heavy oil engines direct coupled to alternators having a normal output of 635 kW. Five miles from the settlement there is a pumping station which supplies all the water required by the inhabitants.

Motor Ships for Venetian Canals

Four new motor passenger cruisers have been built for use on the canals of Venice. Each vessel has a length of 131 ft., a beam of 24½ ft., and a maximum speed of 12.9 knots, and is propelled by a 525 h.p. Fiat six-cylinder engine. The engine room occupies the full breadth of the hull and contains in addition to the main propelling motor, air compressors for supplying starting air to the engines, air storage vessels, electric generator sets driven by oil engines, and pumps. The hull of each ship was built almost entirely by welding, riveting being employed for the hull plating alone. Each ship has a single funnel that is fitted with air slots.



This Metro-Vick 41,000 kW turbo-alternator set at the Barton Power Station, Manchester, has a remarkable record of service and reliability. Photograph by courtesy of Metropolitan-Vickers Electrical Co. Ltd., Manchester.

Russian Canals for Large Cargo Ships

If a project that is now under consideration is carried out, Russia will soon possess a splendid canal system capable of bearing large cargo vessels. It is proposed to enlarge an existing series of rivers and canals known as the "Maryinsky Waterway," which connect the Baltic with the Volga, and to extend the system so as to connect Moscow with Leningrad, the Baltic, the White Sea and the Volga. A canal is also to be built to connect the Volga with the Black Sea, and work on this is to be started next year. When it is finished vessels will be able to pass direct from the Arctic to the Black Sea.

Lancashire's Largest Power Station

A new 51,600 kW BTH turbo-alternator that is to be installed at the Kearsley Power Station of the Lancashire Electric Power Company will make this the largest generating plant in Lancashire. Some 18,500 tons of material have been excavated and some 4,000 tons of concrete and 110 tons of steel reinforcement have been put into the foundations on which the alternator will rest. The new machine will be brought into operation in August, 1936.

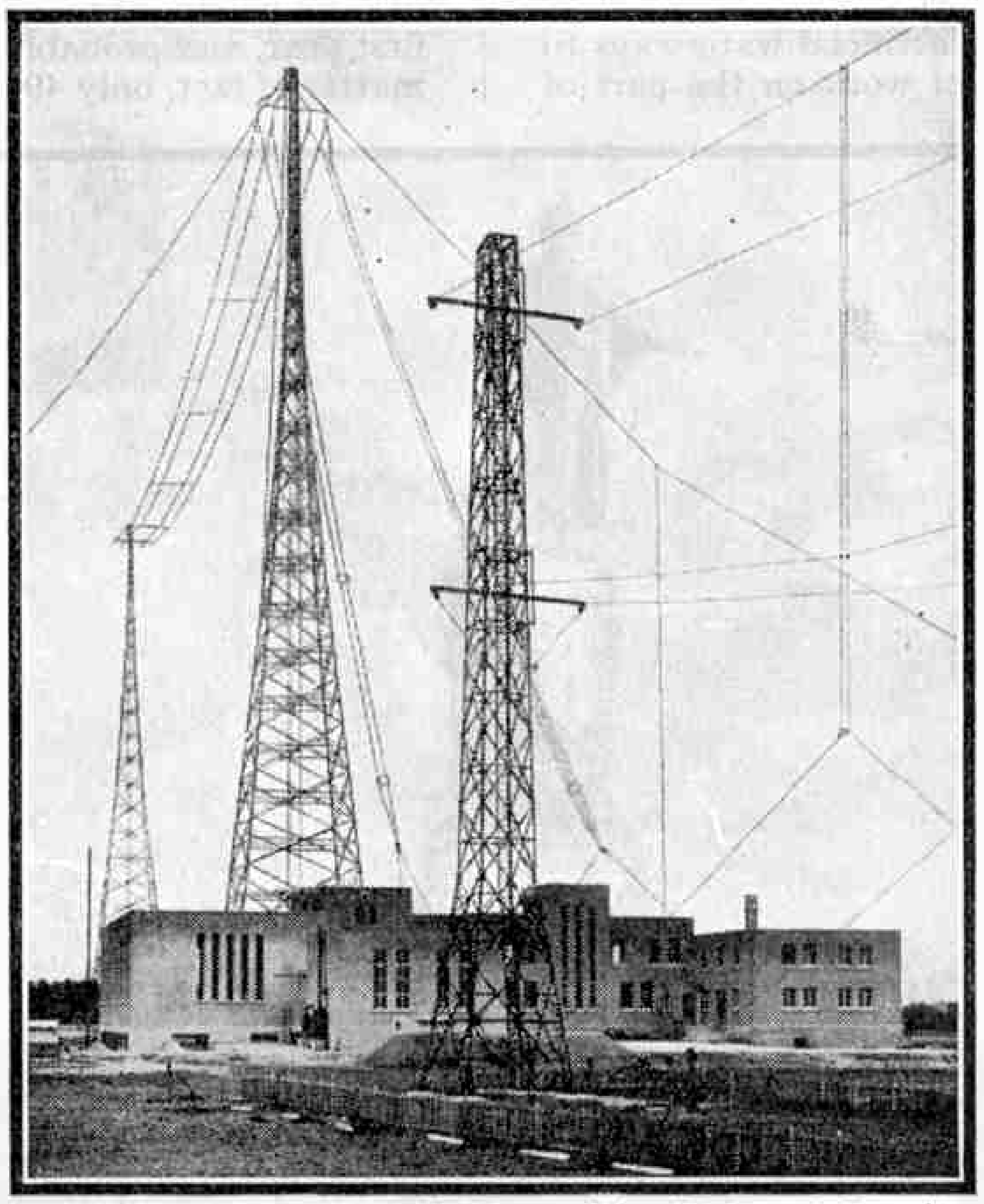
A Tunnel Under the Japan Sea

A new undersea railway tunnel that will be the longest undersea tunnel in the Far East is to be built during the next few years. It will run beneath the Kwannon Straits, the link between the Inland Seas and the Sea of Japan, and will connect Japan's main island, Honshu, with Kyushu. It will be one and two-third miles in length, one mile of which will be under water, at a depth of 120 ft. below sea level and 21.6 ft. below the bottom of the channel, and will be in the form of a tube 28 ft. in diameter.

Boring tests have already been made in the sea-bed, to ascertain the depth, and speed, of the currents.

A Camera with Ten Lenses

A giant aerial camera that is said to be the largest in the world is in use at the new Boulder Dam, in the United States. The great reservoir behind the Dam is now gradually filling, and the photographs, which are being taken at intervals as the water rises, will be used to provide details for making a contour map of the reservoir basin. The camera consists of two units each containing five lenses fitted with separate shutters controlled from an electric master shutter. Ten prints are taken with each operation of the master shutter and these prints overlap to make a composite print 32 in. by 32 in. From an elevation of 30,000 ft., 760 sq. miles of ground area can be included in the composite photograph. The camera complete with the 10 rolls of film needed for a single loading weighs 275 lb. This amount of film is sufficient for 2,000 separate photographs or 200 composites.



The League of Nations Radio Transmitting Station at Prangins (Vaud). Photograph by courtesy of the "Sulzer Technical Review."

Turbo-Alternator's Fine Record

The history of a Metro-Vick 41,000 kW turbo-alternator at the Barton Power Station, Manchester, provides a striking illustration of the reliability of modern electric supply plants. This plant, which is shown in the upper illustration on this page, was first put into service at the end of 1928, and during 6½ years up to June of this year it ran for 49,468 hours out of a possible total of 57,180 hours, and during that period generated 1,580,908,600 units of electricity. The rotor of the machine is 83 ft. 6 in. in length, and about 100 tons in weight, and during the period mentioned made 4,452,120,000 revolutions. The coal consumed in producing the steam to drive the turbine totalled about 854,000 tons. Recently the machine was stopped for inspection and after a few minor repairs had been carried out was put back into service.

An interesting comparison may be made between the speed of the blade tips on the largest wheel in the turbine and the speed of the Earth. The speed of the blade tips is 548 m.p.h., while the surface of the Earth in the latitude of Manchester moves round its axis at 625 m.p.h.

Novel Lighting Effects for the "*Queen Mary*"

Among the many novel features of the Cunard White Star liner "*Queen Mary*" will be a wonderful system of kaleidoscopic lighting in the ballroom. The system will be controlled by a special thyratron valve that is being manufactured by the British Thomson-Houston Co. Ltd., and which will enable hundreds of coloured lamps to be alternately dimmed and brought to full brilliance in a pre-arranged sequence, thus producing fascinating and constantly changing colour effects.

Picking Cotton by Machinery

A new device that has been developed in the United States seems likely to replace hand picking of cotton by machine picking. The machine consists of an endless belt to which are fixed hundreds of driven smooth wire spindles. In action the belt is drawn over a row of cotton plants, and the rotating spindles, which are moistened slightly, collect the cotton pods without injuring the plants. The cotton is then stripped from the spindles and delivered by a fan to a storage bin.

Novel Machine for G.P.O.

An ingenious machine for sorting letters is being tried out at Brighton Post Office by the G.P.O. The machine is reported to have an output of 24,000 sorted letters per hour.

The Suez Canal

Interesting Facts about a Great Waterway

By Harold J. Shepstone, F.R.G.S.

THE Suez Canal, often alluded to by sailors as "The Ditch," which connects the Mediterranean with the Red Sea, has been to the fore of late, as it is by this waterway that Italy transports her troops and munitions to her African colonies, Eritrea and the Italian Somaliland.

By international agreement the waterway is "open to all vessels in time of war as in time of peace without distinction of flag." That rule has always been upheld. In 1914 some German ships reached the canal before the British naval craft could round them up. The British were camped on the canal banks and had fortified works there, but not a shot was fired. When the German ships emerged from the canal, however, they were seized, for "free passage" does not mean "sanctuary."

General view of Port Said, at the Mediterranean entrance to the Suez Canal.

The Suez Canal was the first of the great artificial waterways to be constructed, and it was a daring piece of work on the part of its engineer, M. Ferdinand de Lesseps.

There was a series of lakes along the route of the proposed channel, and de Lesseps decided to run the canal through them. There are five in all, and before the canal was cut they were little more than dried up depressions. The canal track in these lakes has a total length of 27 miles; and the total length of the waterway from Port Said on the Mediterranean to Suez on the Red Sea is 100 miles.

On 25th April, 1859, de Lesseps turned the first spadeful of sand at Port Said, and it was not long before the promoters of the canal recognised the magnitude of their task, and the innumerable difficulties they would have to surmount. Armies of workmen had to be transported to the scene of operations, housed in tents, and provided with fresh water and provisions brought by camels from distant Cairo and Alexandria. At the end of two years not a fiftieth part of the canal had been cut, and it was clear that the original estimate of £8,000,000 set apart to carry out the scheme would be insufficient. As a matter of fact, £17,120,000 was spent before the work was completed. Even so, the width of the waterway had to be reduced in parts to less than one-half of that originally proposed; and to make up for this reduction, "gares," or sidings, were constructed at frequent intervals to allow vessels to pass each other or moor for the night.

The statue of M. Ferdinand de Lesseps, the builder of the Suez Canal, on the jetty at Port Said.

The Khedive of Egypt supplied an army of 30,000 fellaheen, or native labourers, for the heavier and more laborious part of the work, but after some time they were suddenly withdrawn. These men were forced labourers who had been sent to work on the canal by the orders of the Khedive, much against their own wishes. It looked as if the sudden withdrawal of labour would wreck the whole scheme, but the engineers hired as many labourers as they could, and introduced powerful excavating machinery. The last barrier was pierced on 15th August, 1869, almost exactly 10 years from the date of commencing, and on the following 17th November the waterway was opened for traffic. By means of the canal the distance between Western Europe and India is reduced from 11,379 to 7,628 miles, a saving of from seven to ten days in the journey.

M. de Lesseps was sanguine enough to estimate that the tonnage of ships passing through the waterway would be three millions in the first year, and probably twice as much during the second year. As a matter of fact, only 491 vessels used the canal during the first year, representing an aggregate tonnage of 436,618; and it was not until the waterway was nine years old that the three million mark was reached. In an ordinary year some five thousand vessels make use of the waterway, representing an aggregate tonnage of between 25,000,000 and 30,000,000, just over 50 per cent. being British. The dues paid by these ships amount to between £7,000,000 and £8,000,000. Loaded ships are charged 6s. 8d. per ton, ships in ballast 3s. 4d. per ton, plus 8s. 4d. for each passenger.

It required experience to find out the most effective way of handling the large and valuable ships for which the waterway specially catered. For instance, it was not until 1886 that ships could pass through the canal at night. This difficulty was got over by making each ship illumine her own course by carrying a powerful searchlight capable of spreading light 400 ft. ahead. Vessels that do not possess such lights can hire them on entering the waterway at Port Said and return them on leaving at Suez.

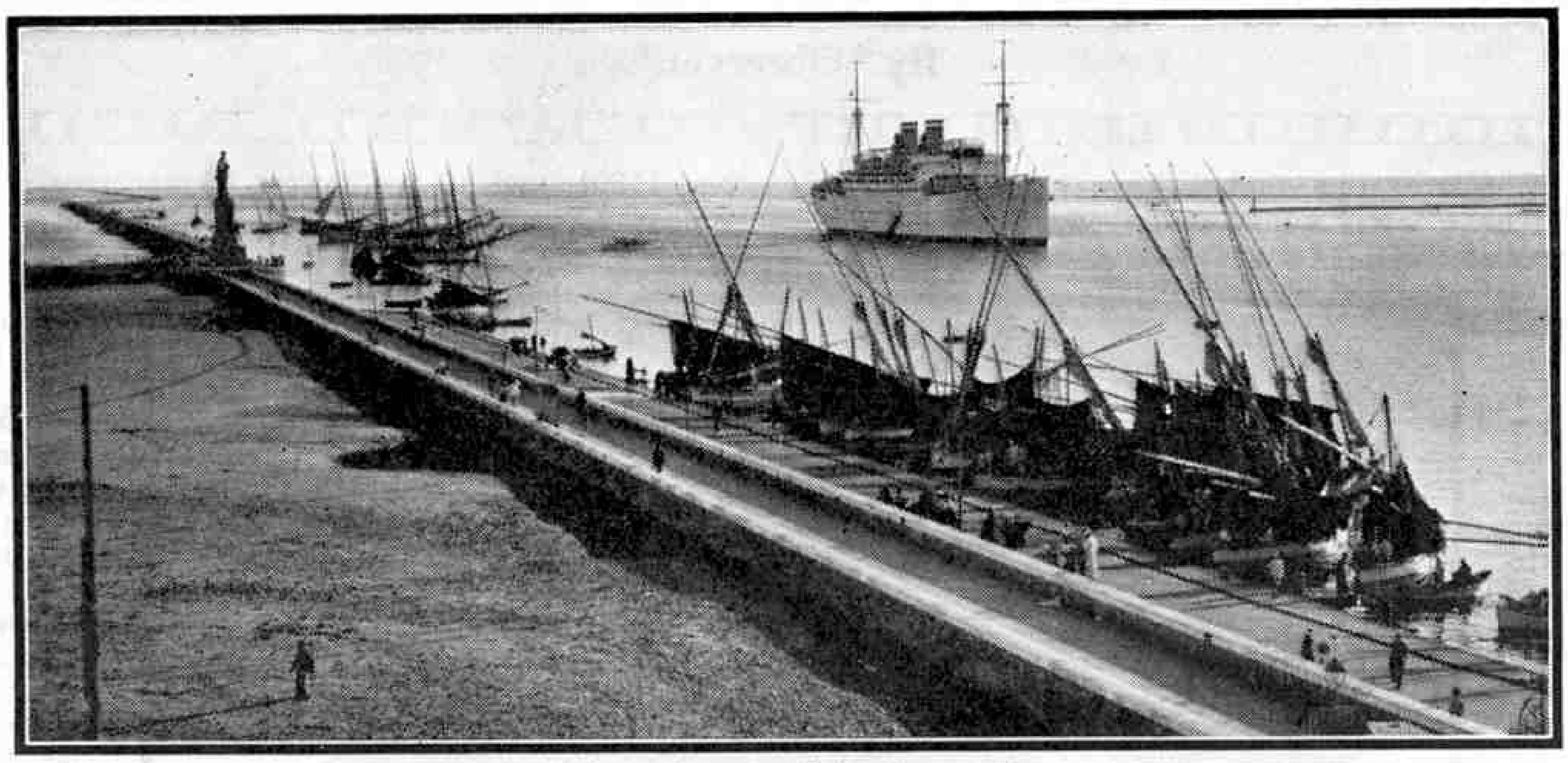
The first ship that effected a free passage by night was the P. and O. steamer *"Carthage,"* which accomplished the journey in 18 hours. Hitherto vessels had to take anywhere from 24 to 36 hours to cover the 100 miles.

To many readers the rules governing ships while making the passage may seem strange. Written information as to his ship must be handed in by each captain—her name, nationality, draught, and port of sailing and destination, as well as his own name, and that of owners and charterers, and the number of passengers and crew.

Warships, too, have to supply a copy of their muster roll.

Naturally nothing must be thrown overboard, especially ashes and cinders; also nothing is to be picked up, notice of any article lost overboard being left at the nearest station. No guns shall be fired, and no steam whistles blown, except in cases of extreme danger. One rule also states that no burial is permitted in the canal banks. All sailing vessels above 50 tons must be towed, above 150 tons they must take a pilot, and no sailing craft may navigate at night. While pilots are compulsory, the entire responsibility still rests with the captain. If local pilots know the canal better than a stranger, it is argued that captains know more thoroughly the peculiarities and steering capabilities of their own ships.

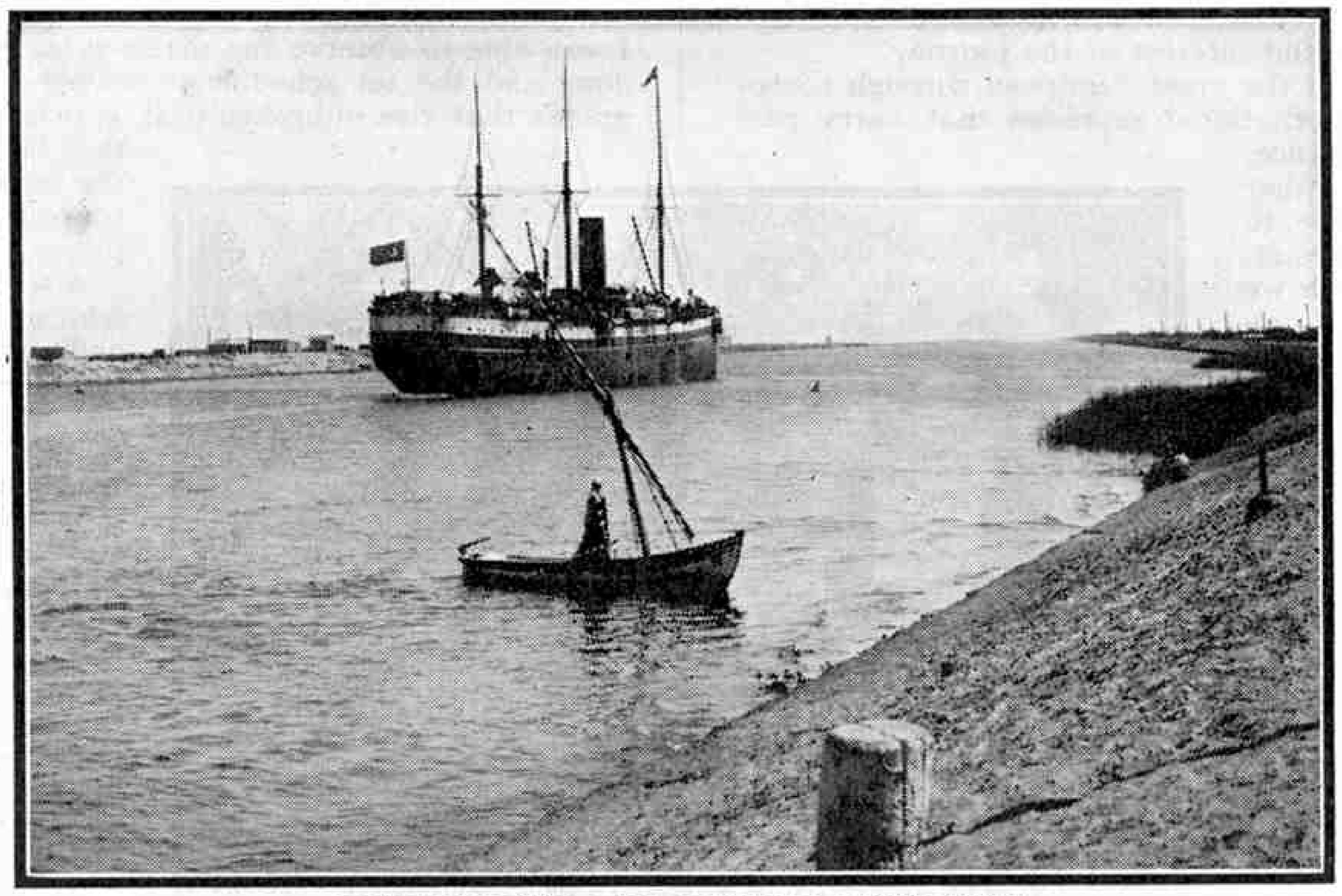
If a collision appears likely, all ships are instructed to run aground to avoid it, the yielding nature of the shallows near the banks offering the lesser of two evils. But no other ship is permitted to help off a grounded one.



A large steamer entering the canal.

Ordinary steamers make the passage of 100 miles in 16 hours. There is nothing particularly exciting in the trip. Entering at Port Said, the canal crosses about 20 miles of Lake Menzaleh, and 22 miles farther on it reaches Lake Timsah, where is situated Ismailia, to-day a flourishing city boasting of its theatres, cinemas, hotels, restaurants and clubs, where the officials of the canal and the pilots reside. Fifty years ago it was a small Arab village.

On each side of the narrow waterway stretches the boundless desert. Here and there one is pointed out places of Biblical and historical interest. Now and again, too, one catches sight of a caravan of laden camels patiently wending their way along the routes that have been in use for carrying merchandise in this way for thousands of years.



Another view of the canal, showing the typical scenery.

A fine plan for giving safety to all ships in transit is in operation, much resembling the well-known block system. The company control the departure and entrance of all ships, the order of precedence being wholly in their hands, by which not only safety but the speed of mails is ensured. No ship may demand immediate passage for any reason, but preference is given to regular mail steamers under Government control.

The canal is blocked out in divisions, and at the head office in Ismailia a dummy model shows the exact moving position of everything afloat. No vessel may proceed until the way is clear, and a complete system of telephonic signals ensures this being done. Along the banks are small stations, 12 between Port Said and Suez, each furnished with a high masthead, from which red and yellow balls by day, and coloured lights by night, announce to each vessel whether to proceed through the next division or to "tie-up" and wait for one to go by from the opposite direction. Ships proceeding in the same direction are not allowed to pass one another. Every five or six miles there is a short widening, or "gare," where vessels make fast.

With all these precautions, collisions do occasionally occur, and ships have sunk and held up the traffic for days. The most recent striking instance was the case of the steamer *"Chatham,"* which took fire and was scuttled. She had about 100 tons of dynamite on board, as well as a supply of detonators. It was decided to blow up the vessel, and this was accomplished by means of large mines fired by electricity. The firing station was located three miles from the sunken wreck. When the mines were fired an enormous column of water and debris immediately arose, and ascended continuously for five seconds, the estimated height of the column being over 1,500 ft. The water of the canal overflowed the surrounding country for a thousand yards in every direction, and fragments of the ship were distributed over a circle 1,200 yards in diameter. The enormous downward thrust of the explosion was shown when soundings came to be taken over the spot where the ship had lain. There was found a huge hole 73 ft. in depth.

The result of this accident was that within a period of four days the authorities had to handle no fewer than 109 vessels that had been delayed, 53 passing from the north, and 56 from the south, directly the canal was re-opened, and this was successfully accomplished without the slightest hitch.

When first opened the canal had a level depth of 26 ft., a width at bottom of 76 ft., and a width at water level of 150 ft. It is now 38 ft. deep, with a width at bottom of 147 ft., and from 240 ft. to 360 ft. in width across at the water level. It is still being deepened and widened; and on this work alone more than £14,000,000 has been expended since the waterway was opened to traffic. Quite apart from enlarging the canal, a whole fleet of dredgers is continually engaged on merely keeping the channel free from sand. In one year three million cubic yards of material were taken out of the canal by these dredgers.

Despite the heavy cost of running the waterway and keeping it open for traffic, the scheme has been a financial success almost from the first, and Suez Canal shares are always much sought after. By the purchase, in 1875, of a big block of shares originally held by the Khedive, the British Government obtained a joint control over the canal with France. To-day the British Government owns some 44 per cent. of the share capital, most of the balance being held in France. But France and Britain are only controlling the waterway for the time being as trustees. Legally speaking, it is an Egyptian concern. On 17th November, 1968, thirty-three years from now, the canal passes automatically to the Egyptian Government, just as leasehold property passes back to the ground landlord at the termination of the lease.

As regards the future of the canal there are several possibilities. First, the maintenance of the *status quo*, Britain protecting and France running the works as she does now; second, the canal to be run internationally through the League of Nations; third, for the waterway to be reorganised on an Anglo-Egyptian basis; and fourth, for Egypt to take over the canal, which is what she says she intends to do.

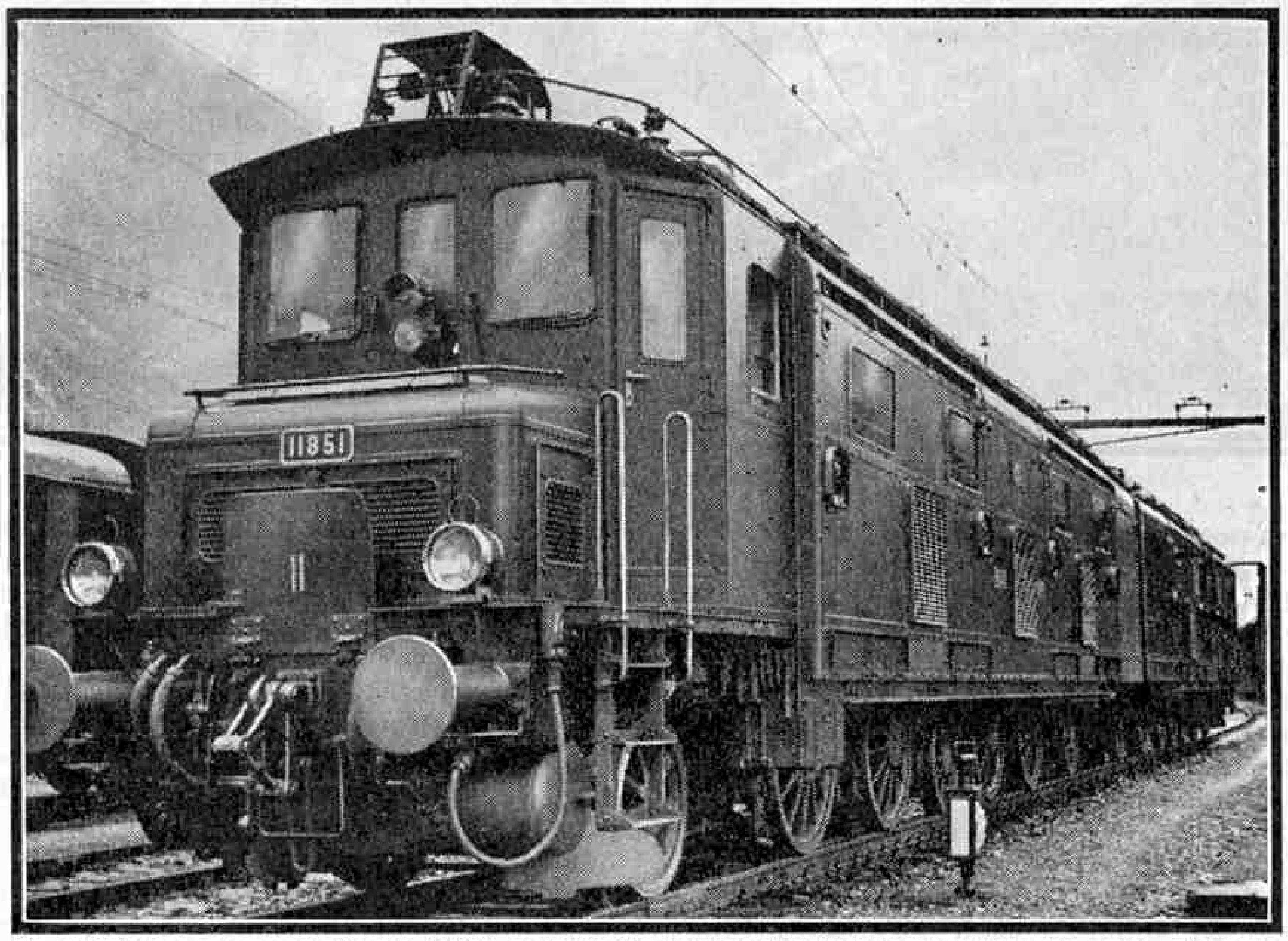
Through the Alps on the Footplate

The Wonders of the St. Gotthard Line

By "Observer"

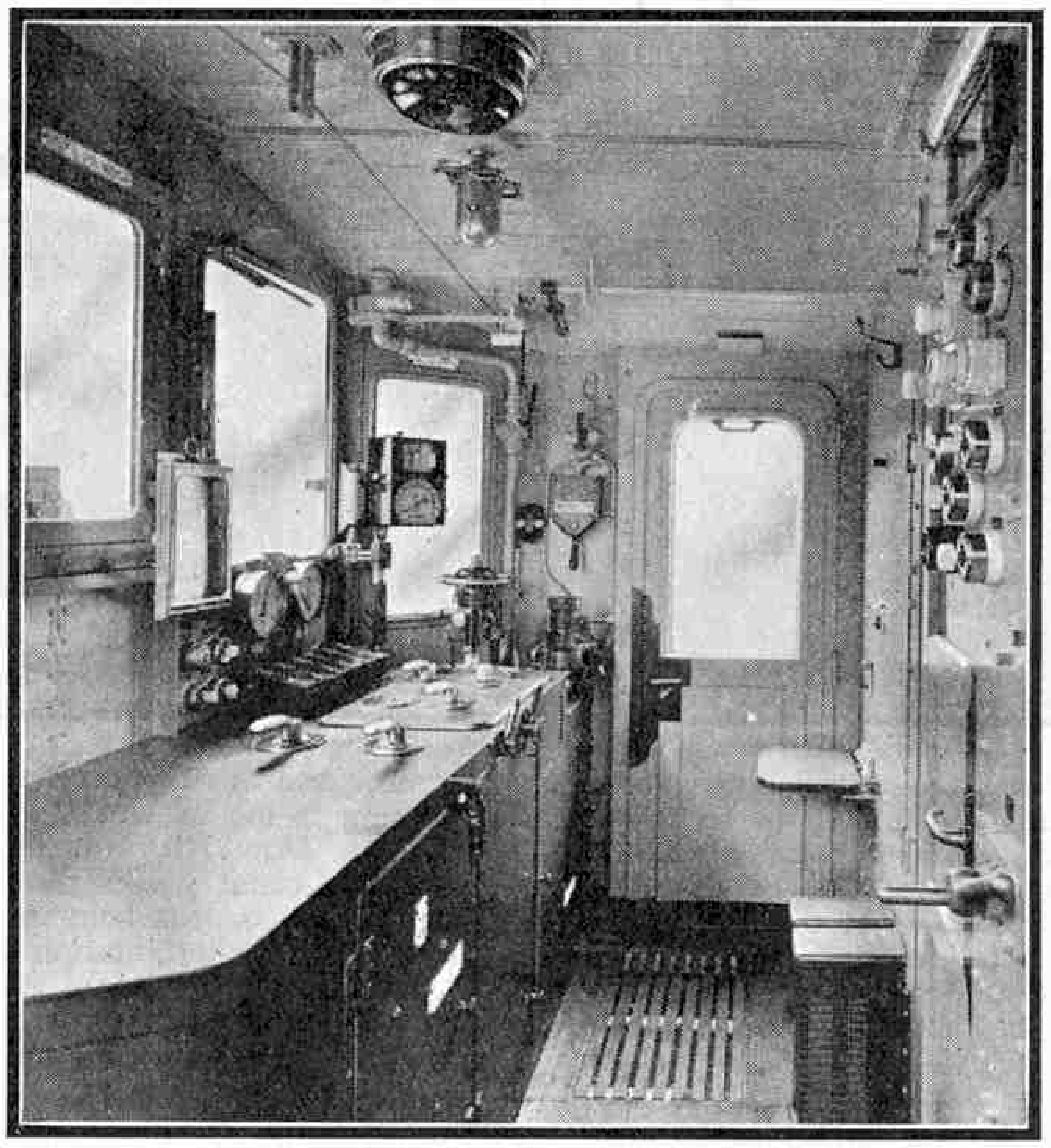
TO the numerous footplate trips that I have had the good fortune to make, I have lately added one that will, I think, long remain the most memorable of all. It was over the wonderful St. Gotthard route in Switzerland, and by favour of the authorities of the Swiss Federal Railways I was able to travel all the way from Lucerne to Lugano in the driver's cab and to observe the scenic beauties and engineering marvels of the line from that excellent point of vantage.

It was an enthralling, never-to-be-forgotten experience. The weather conditions were perfect, with brilliant sunshine and cloudless skies all the way. I was favoured, too, in having as a companion on the footplate an English-speaking technician, Herr F. Wüscher, from the locomotive department at Lucerne, who gave me all possible information, and by his friendly help added much to the pleasure and interest of the journey.



No. 11851, the sister engine to No. 11801 on which the journey described in this article was made. The illustrations are reproduced by courtesy of the Swiss Federal Railways.

The Gotthard line is one of the great European through routes over which travel heavy international expresses that carry passengers from Britain, France, Germany, Belgium and other countries of Northern Europe to Italy and other lands beyond. The particular train by which we travelled was the one leaving Lucerne at 10.40 a.m., and our locomotive, electric, of course, was No. 12342, built in 1922, and having the 2-4-4-2 wheel arrangement. The train behind us weighed, with passengers and luggage, 400 tons. At Arth-Goldau, where we made our first stop, we picked up some coaches from Zurich, thus bringing up our load to close on 500 tons. Included in this heavy train were some through coaches from Amsterdam to Genoa, while other vehicles were marked for such diverse destinations as Locarno, Chiasso, Milan and Ventimiglia.



A view of the driver's cab of No. 11851, showing the excellent lighting and convenient arrangement of the controls.

In the earlier stages the line ran for much of the way close to the lovely Lake of Lucerne, but from Fluelen onward our route lay up the valley of the turbulent river Reuss, and here we had to cope with gradients that rose with increasing severity. At Erstfeld, 37½ miles from Lucerne, we stopped for a change of locomotive before tackling the mountain section of the line, and my best expectations were realised when No. 11801, one of the newest locomotives of the Swiss Federal Railways, backed on in place of the one that had brought us from Lucerne.

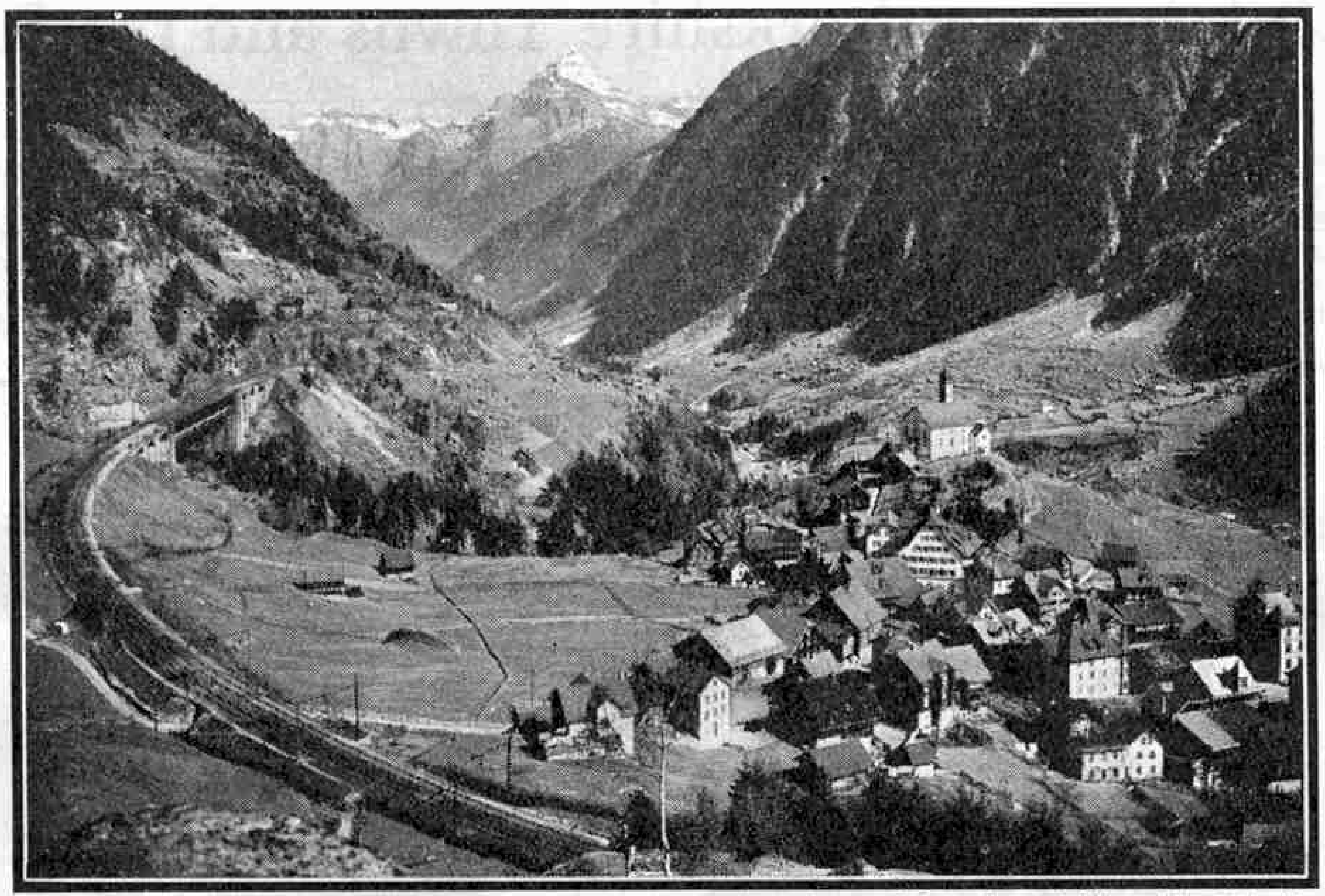
Only one sister engine of the class, No. 11851, has been built as yet, and with a horse-power of 8,500 they rank among the most powerful locomotives in the world. Each has a length of 111 ft., weighs 244 tons, and runs on 28 wheels, the wheel-notation being 2-4-2-4-2+2-4-2-4-2. Owing to their great length they are articulated, being composed of two similar halves closely coupled together. No. 11801 has 16 driving wheels of 5 ft. 3⅜ in. diameter. No coupling rods are used, as each driving axle has a separate motor. This mammoth locomotive was designed to haul express trains of 600 tons at a speed of 40 m.p.h. over the mountainous grades of the St. Gotthard route, and in the course of my trip I was able to observe the masterly ease with which its work was done and the set schedule improved upon. Even on the terrific grades that rise unbrokenly at between 1 in 37 and 1 in 40 for the 18 miles from Erstfeld to the entrance of the St. Gotthard tunnel at Göschenen, it simply played with its heavy train.

After a gentle start from Erstfeld, acceleration was very rapid, and within three miles we were travelling at 57 m.p.h., only five less than the maximum of 62 miles, or 100 kilometres, per hour allowed on this route. But soon the driver eased his engine and we settled down to an even 44 m.p.h., except when permanent way repairs called for much reduced speed. Steadily, resistlessly, we mounted upward, the scenery meanwhile becoming more grandly Alpine. On the line itself a succession of exceptional features claimed attention.

At Amsteg we crossed a lofty viaduct that spans the entrance to the Maderaner Valley, while down below we saw the power station from which, in conjunction with a similar station at Ritom on the southern section, the Gotthard line derives its motive power. As we neared Wassen I noted with heightened interest the extraordinary engineering devices that had to be employed to enable the line to rise with the ever-steepening bed of the valley. Bearing away to the right we plunged into a tunnel that pierces the hillside and in the course of 1,635 yards describes a complete spiral; from which we presently emerged 115 ft. above the point at which we entered. A little later we negotiated two similar corkscrew tunnels which raised the line a further 400 ft.

One surprising consequence of this ingenious planning was that we passed the prominently-placed Church of Wassen no less than three times; the first time we were considerably below it; the second, about level with it; while the third time we looked down on it from above!

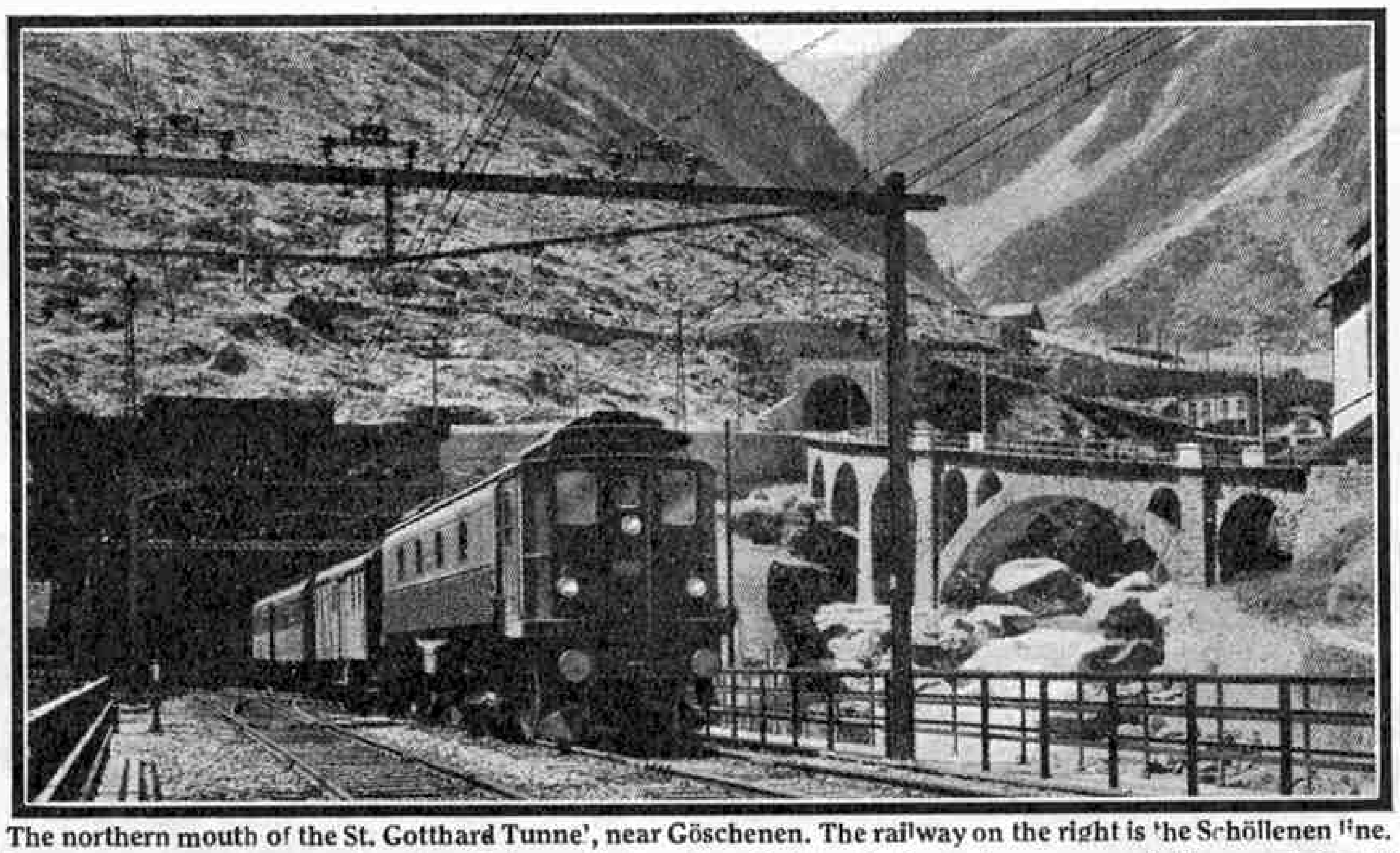
At the next station, Göschenen, 55½ miles from Lucerne, our laborious climbing ended, and on resuming our journey after a brief stop we found ourselves entering the great St. Gotthard tunnel, the third longest in the world. This colossal engineering work took 10 years—from 1872 to 1882 — for its execution, and its cost amounted to £2,700,000. It has a length of 9.3 miles, a width of 28 ft. and a height of 21 ft., and double tracks are laid throughout. It is quite straight except for a curve at the south end, and gradients rise moderately from each end to the summit in the centre, which is 3,786 ft. above sea level. With electrical working the air is clean and fresh, but in former days when steam traction was employed, three engines frequently being required on a train, it was often very foul and offensive, and all carriage windows had to be closed tightly during the passage through the tunnel. Our transit of the tunnel was made in 10 min. 50 sec., and for the greater part of the time the speed indicator showed a steady 90 kilometres, or 56 miles, per hour. Within a minute of leaving the tunnel we had come to a stand in Airolo station.



A picturesque view on the St. Gotthard line near Wassen. This village is passed three times at different levels by the railway on the ascent to the St. Gotthard Tunnel.

Journeying forward, steeply falling grades took us down the Leventina Valley, where the charming scenery was distinctly Italian in character. Passing Piotta, we saw the funicular line that ascends to Ambri and claims to be the steepest railway in the world, with a maximum gradient slightly steeper than 1 in 1¼! Near Rodi Fiesso and at Giornico we negotiated some more wonderful spiral tunnels. At Biasca, 93¾ miles from Lucerne, we reached the southern end of the mountain section, and thereafter gradients became more normal. At this point, where running was very steady, my guide conducted me through the interior compartments of the locomotive, and I was able to observe the motors in operation.

During a stop at the ancient town of Bellinzona our train was relieved of its Locarno portion, and here we were only 760 ft. above sea level and more than 3,000 ft. lower than we had been at the summit in the tunnel. In the closing stages of our journey, after a stiff ascent to Rivera we had descending grades before we arrived, punctually at 2.35 p.m. at the delightful resort of Lugano, 124 miles from Lucerne. Here I descended from the cab, but the locomotive and its crew went onward with the train a further 16 miles to Chiasso, the frontier town where Switzerland and Italy meet.



The northern mouth of the St. Gotthard Tunnel, near Göschenen. The railway on the right is the Schöllenen line.

For the return working, No. 11801 and its crew would leave Chiasso at 6.21 p.m. with an express for Lucerne, arriving there at 10.5 p.m. At 11.50 p.m. they would leave again with a southbound express, and while the driver and his mate would be relieved at Erstfeld, the locomotive would go through to Chiasso, reaching there at 4.15 a.m. The final trip of its day's schedule would be to take a heavy freight train from Chiasso to Erstfeld, leaving the former place at 6.58 a.m. and arriving at the latter at 10.15 a.m. After less than two hours for rest and cleaning at its depot at Erstfeld, it would be due to take up its daily round again by coupling on to the 10.40 a.m. from Lucerne on its arrival at Erstfeld just before noon.

Such a rota shows that this monster locomotive is being employed to the fullest extent. My own trip on its footplate gave me a deep impression of its remarkable capabilities and high efficiency. The running at all points was extremely smooth and done with a sense of effortless ease.

In the course of the journey, we made 11 scheduled stops, which occupied in all 42 min. 20 sec., leaving 192 min. 40 sec. running time for the 124 miles and yielding an average speed approximating to 40 m.p.h. This may seem low as compared with that of many crack flyers, but when load, gradients, curves, special restrictions and numerous stops have been taken into account, it is safe to say that there is no more meritorious running in the world to-day than that on the mountainous main lines of Switzerland.

The driver and his mate were keen on their job. Since the "fireman" has no firing to do, he is able equally with the driver to keep a sharp look-out. Whichever first catches sight of a signal calls to the other whether it is "off" or not. The cab is roomy and comfortable with its controls all conveniently placed. Automatic train control apparatus is also fitted. Radiators ensure warmth for the crew on wintry days when the weather over the St. Gotthard route is Alpine in its severity.

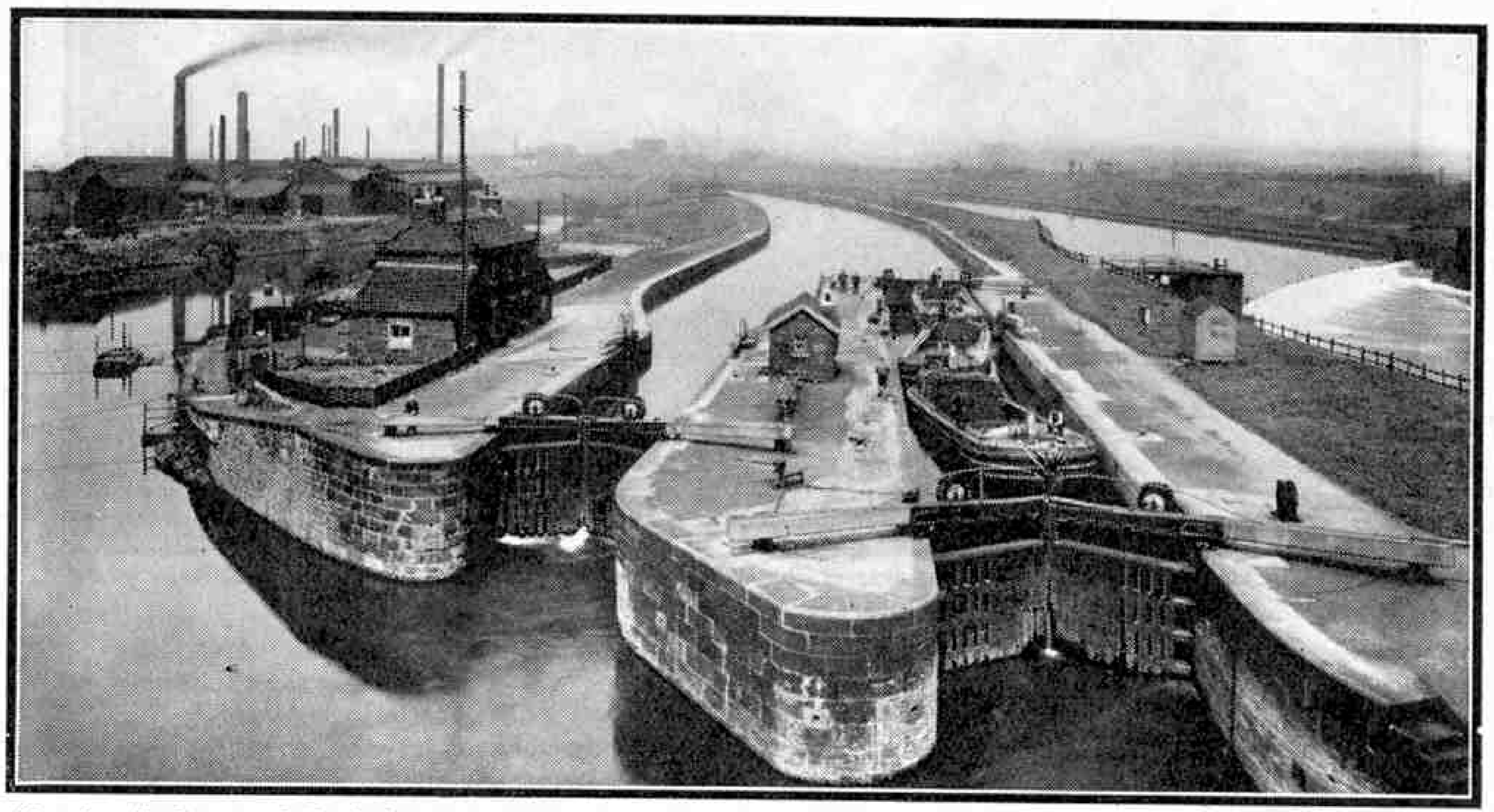
An interesting provision, made with a view to exact time keeping, is the fixing of a copy of the working time-table before each of the crew so that he may see at a glance the schedule to which he is working. The time-table is held in a metal frame with a glass cover and the rules strictly require that the correct page must always be turned to view. A speed recorder and a variety of gauges also help the men on the footplate to work their locomotive and train punctually and efficiently.

This trip over the great St. Gotthard route confirmed me in my opinion that there are no railways more wonderfully constructed or more ably operated than those of Switzerland, and of all my footplate runs this was certainly the cleanest, smoothest and most exhilarating.

The Aire and Calder Navigation

Link between Yorkshire Towns and the Sea

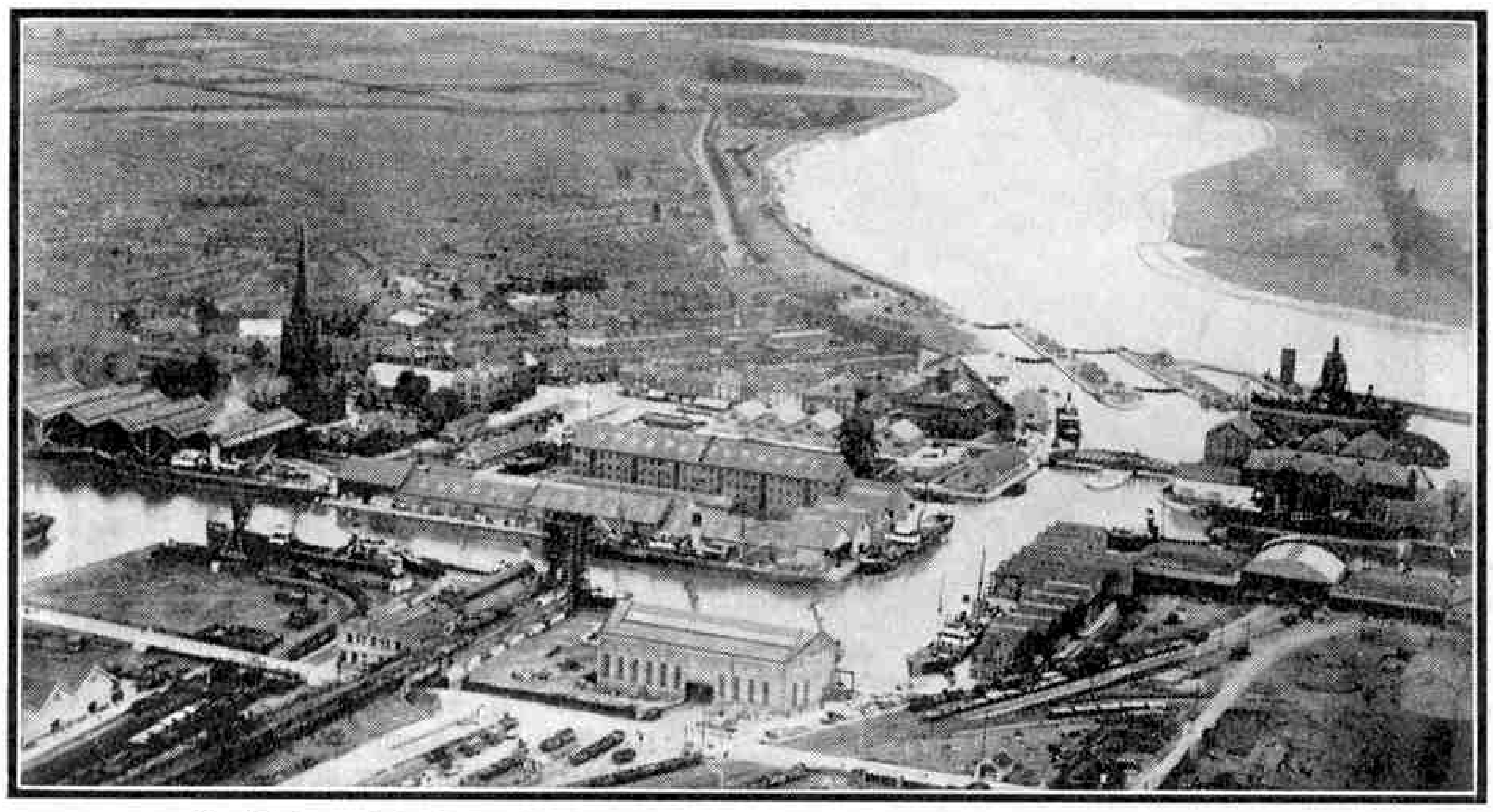
IN the 17th century the lack of good roads from inland towns to seaports was balanced to some extent by the extensive use of rivers for the transport of freight from towns on their banks to convenient ports. The Aire and Calder Navigation owe their existence to the need at that time of better river transport between inland Yorkshire towns and the sea.



Knostrop Lock, one of the locks on the upper section of the Navigation through which traffic to Leeds has to pass. The illustrations to this article are reproduced by courtesy of the Aire and Calder Navigation.

The company began in a small way in 1698 by improving the rivers Aire and Calder, from Leeds and Wakefield respectively, down to Castleford where they meet, on to Knottingley, and down the Lower Aire where it joins the River Ouse. By 1774 traffic from Leeds and Wakefield had increased so greatly that the company provided an additional outlet to tidal waters by cutting a short canal from the River Aire at Haddlesey to the River Ouse at Selby. The Aire and Calder were made more navigable by the construction of short cuts at various places to avoid sharp bends and dangerous shoals.

Freight traffic on the Navigation's waterways continued to increase, and in 1820 important developments to cope with it were begun, including the creation of a port at Goole on the River Ouse, and the construction of a canal from there to Knottingley. The port provided the company with their own connection with the tidal waters of the Humber. In 1828 the docks at Goole were extended, and the main waterways were deepened so that vessels of up to 250 tons could pass up to Leeds and Wakefield, and when outward bound could reach Goole in eight hours.



Aerial view of Goole Docks, looking East. The main entrance locks are on the right.

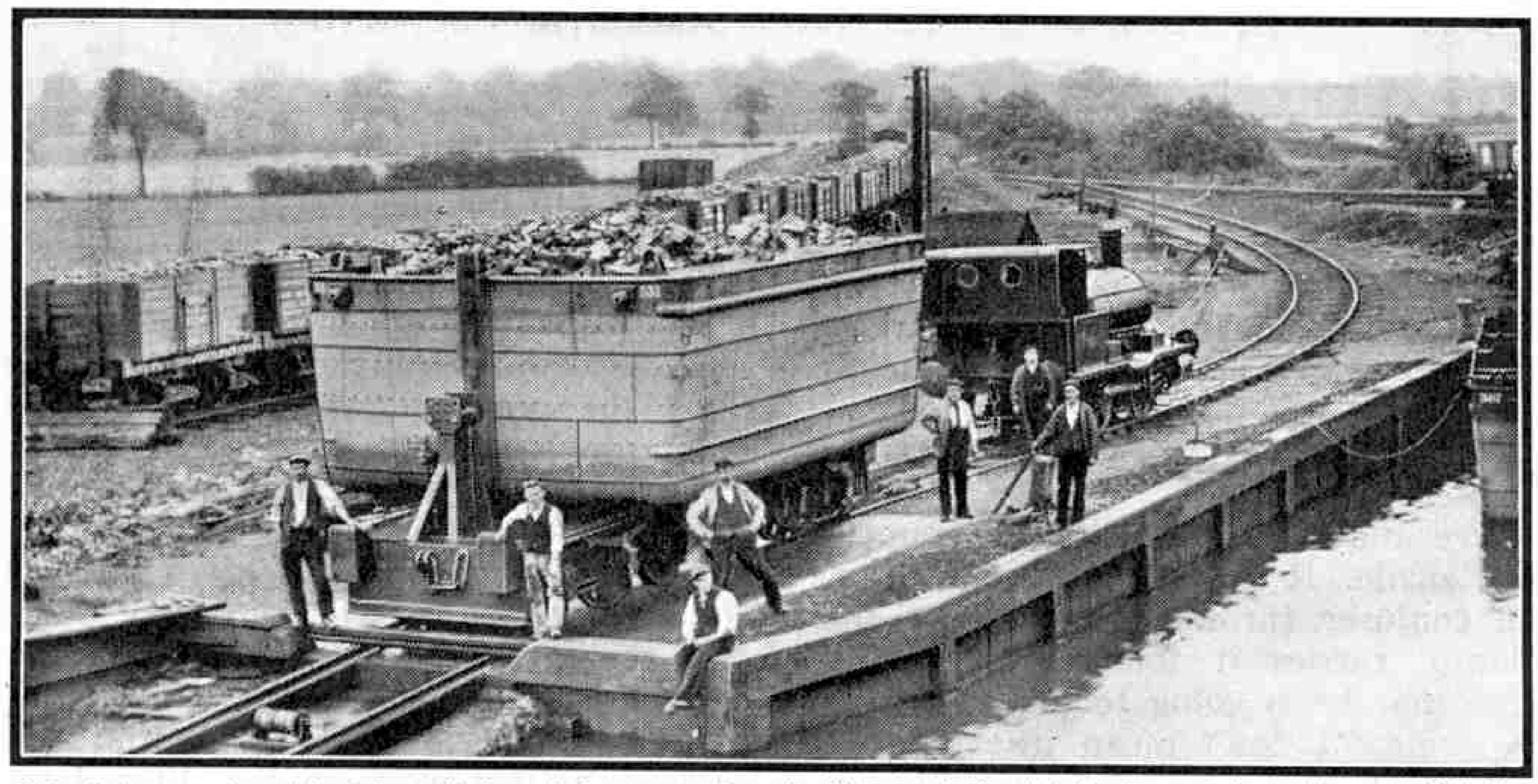
Other improvements carried out about this time included the enlarging of the locks to enable as many as five barges to pass through at the same time, instead of only one as formerly. The shortest lock on the main waterways is 208 ft. in length and the narrowest one is 17 ft. 9 in. in width. The low stone arch bridges at many points were replaced by girder bridges of greater height and width, and boats can now pass each other at these places as on the open stretches. The bridges between Leeds and Goole provide a minimum headway of 12 ft. 9 in. and those between Wakefield and Castleford of 11 ft. The bends of the waterway can easily be negotiated, and the sharpest can be navigated by vessels 120 ft. long, 17 ft. 6 in. in width and of 7 ft. 6 in. draught. These big developments placed the company in the unique position of owning both a fine system of navigable waterways and their own port, and enabled them to meet the severe competition created by the rapid development of railways.

During the first 100 years of the Aire and Calder Navigation other inland waterways became established, and several of these catered for territory adjoining that served by the Navigation. From time to time the company therefore extended their canal system by acquiring some of these smaller concerns, including a canal from Wakefield to Barnsley. The company shared with the Sheffield and South Yorkshire Navigation the cost of constructing the Junction Canal, a short but very important one that connects the two systems of waterways. It joins the Aire and Calder Navigation about seven miles above Goole, and the Sheffield and South Yorkshire Navigation near Stainforth. To-day the Aire and Calder Navigation is 80¼ miles in length, and its connections with other inland waterways provide 700 miles of canal communication.

The Navigation have a fleet of barges ranging from 50 to 150 tons capacity for the transport of merchandise, and a fleet of steam tugs to tow them. Diesel-engined tugs are also largely utilised by certain carriers on the waterway, particularly in connection with the petroleum and fuel oil traffic. A special service of night tugs is engaged in towing to their destinations barges that have been loaded during the day, so that the cargoes can be delivered or re-shipped next day. The banks of the waterways are protected against the wash caused by the propellers of screw-driven vessels.

The waterways of the company pass through the principal portion of the West Yorkshire coalfield, and many collieries use them for the conveyance of coal to Goole by means of the company's compartment boat system. It is claimed that this is the most economical and efficient method of transporting coal in this country, and it is not used anywhere abroad. The compartment boats, or "Tom Puddings" as the watermen have nicknamed them, are floating iron or steel boxes 20 ft. in length, 15 ft. in width and 8 ft. in depth, and hold 40 tons of coal. The ends of each boat are slightly curved, and there is a recess in the after end to receive the vertical stem of another boat, which can then be coupled to it. In this way a train of 19 or more loaded compartment boats, conveying a total of from 700 to 800 tons of coal, is made up, and it is towed to Goole by one of 18 tugs specially built for the work. Each tug has a crew of four men.

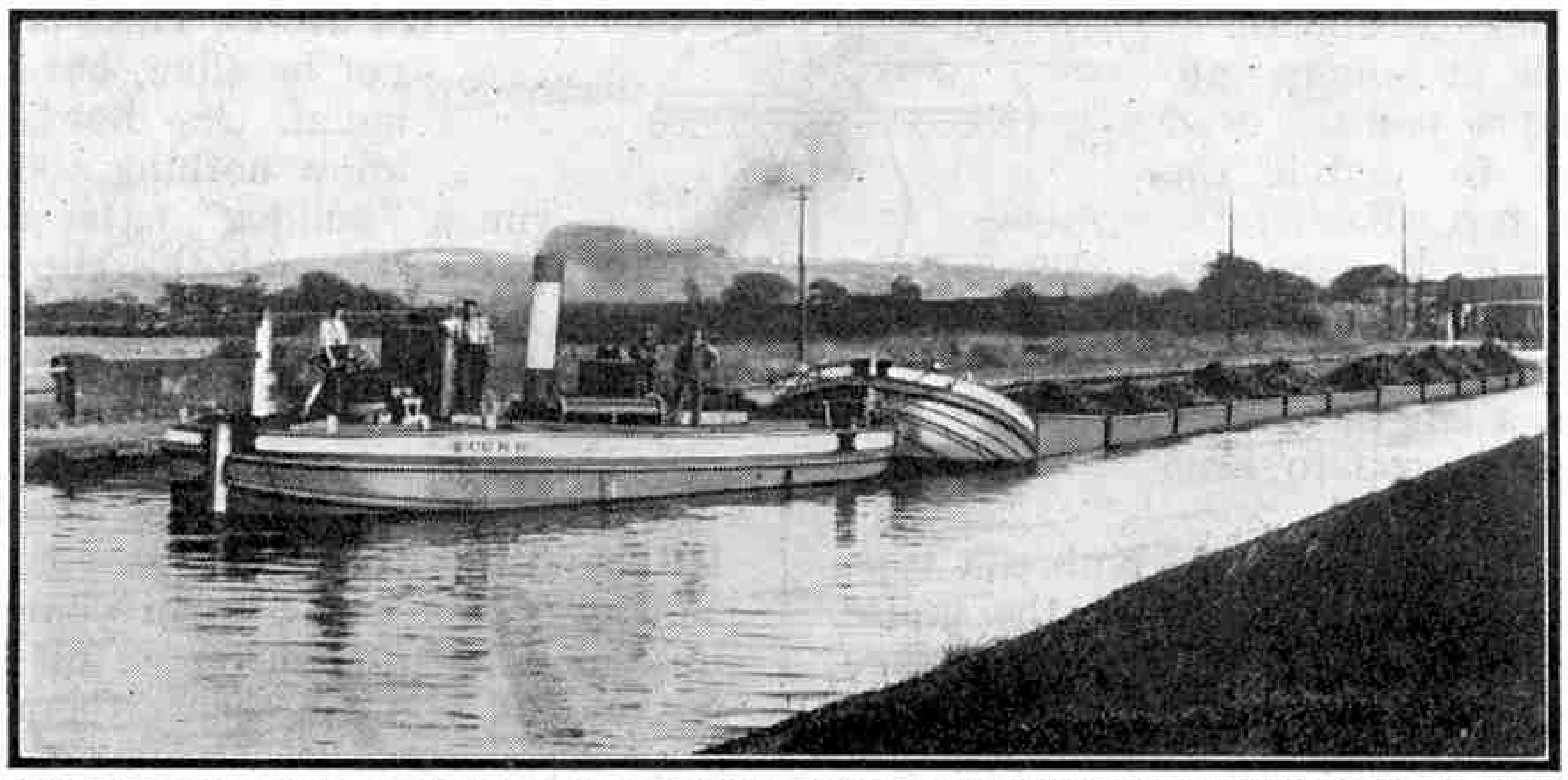
One of the trains is shown in an illustration on this page. Between the tug and the first boat is what appears to be the cut-off portion of an ordinary barge. This is a "headpiece," or leader, and its purpose is to divert the wash set up by the tug's propeller, and thus prevent it from swamping the train. When a train of empty boats is in tow the headpiece is attached to the front of the tug. The slightly curved ends of the boats enable the latter to navigate easily the bends of the waterways, and a pair of spring buffers at the fore end of each boat enable the train to straighten quickly after passing round a bend. The demand for these unique boats is very great, and the Navigation own 1,100 of them.



A loaded compartment boat brought by rail from an adjacent colliery and about to be lowered down the ramp into the Stanley Ferry Basin, where it will float off the bogie.

Some of the collieries using the compartment boat system are not very close to the waterways, and communication is provided by a railway line from the colliery to a special basin, or enclosed water space, built alongside and connected with the waterway. At the basin the track extends down a concrete ramp into the water. The empty compartment boats are left by the tug in the basin, and are withdrawn one at a time by means of a specially-built 12-wheeled bogie that is lowered down the ramp so that the boat can be floated over it. The bogie is then hauled up, raising the boat with it. When the other boats of the train have been brought up in the same way and made fast to the bogies, the latter are coupled up and hauled to the colliery by the company's locomotive, exactly like a train of ordinary railway wagons.

At the colliery the boats are shunted beneath screens through which the coal is loaded into them, and when full they are taken back to the basin by the locomotive. The bogies are uncoupled, and each is lowered slowly down the ramp until sufficiently submerged for the boat to float away, when the bogie is hauled up again. A special braking system controls the lowering of the boats down the ramp. It is also interesting to note that each basin has been designed so that the compression of water in it helps to arrest the momentum of the boat as it enters the water. The floating boats are coupled up to form a train, a headpiece is attached, and the train is then ready for the tug to tow it to Goole.



Compartment boat train on the way to Goole. Between the tug and the first boat is a "headpiece" to divert the wash set up by the tug's propeller.

In the case of collieries situated very close to the waterway, the compartment boats remain in the water but are moored alongside a coaling staith or wharf, and the coal is discharged down chutes into them. The loaded boats are dealt with in the same manner as those in the basins. The locks on the portion of the main waterway from Castleford down to Goole are large enough to accommodate a whole train of compartment boats, together with tug and headpiece, and this avoidance of any uncoupling results in a great saving in time.

On arrival at Goole the train is divided up, unless of course all the coal is destined for one ship, and the compartment boats are sorted according to their destinations. They are then towed by tugs to one or more of four hydraulically-operated hoists alongside which are berthed the ships awaiting the coal. These hoists have a lifting capacity of 100 tons and are of special construction. The cage of each hoist carries a U-shaped receptacle called a cradle, and both are submerged when at the foot of the hoist, so that a loaded compartment boat can be floated on to the cradle and clamped in position. It is then elevated by the cage to the top of the chute, the cradle and boat are tilted mechanically, and the coal descends the chute into the holds of the ship. When the compartment boat is emptied the cradle returns it to the cage and all three descend to the bottom of the hoist, where the boat is released and floated clear. One of the hoists is fixed on a floating pontoon.

There are also ordinary hoists of 25-tons, 40-tons and 50-tons lifting capacity for tipping coal from railway wagons, and for heavy lifts. Coal tipped down a chute often breaks up considerably as it descends into the ship. About two years ago the Navigation equipped one of their hoists with a Mitchell anti-breakage appliance, and it has proved so satisfactory in reducing the breakage of the coal to a minimum that similar equipment is to be fitted to the other hoists.

The port of Goole has an advantage over the Humber ports in being the nearest one to the large industrial areas of West and South Yorkshire, and it is well equipped for dealing with many branches of commerce. In addition to the hydraulic hoists and cranes for the coal traffic, there are powerful electric cranes for handling general merchandise; ample shed and warehouse accommodation, and extensive wharves. Ships of up to 2,000 tons can reach Goole, and when the improvements on the upper portion of the River Humber now in hand are completed, the port will be accessible for ships of 4,000 tons. The two main entrance locks from the River Ouse are 500 ft. in length and 47 ft. in width, and 264 ft. in length and 58 ft. in width, respectively. An additional large entrance lock, designed to accommodate 4,000-ton vessels, is being constructed at the south-east corner of the port. The nine docks have a total water area of 46½ acres and three miles of quayage. They are all connected, and the water in them is maintained at a fixed level unaffected by tides. There are three dry-docks for ship repairs, and the largest of these can accommodate ships 270 ft. in length and 50 ft. in width.

The Navigation send their boats alongside ships in the docks at Goole and Hull, in addition to receiving traffic from the quays. Canal boats of a special type are employed for the transport of petroleum spirit from these ports to depots at Hunslet, near Leeds, and at other points alongside the waterway, where the spirit is pumped direct into the storage tanks of the oil companies. At the present time there are 17 petroleum and fuel oil depots on the waterway, and the quantity carried last year amounted to 36,600,000 gallons. Another important branch of the Navigation's activities is the collection of freight from, and delivery to, towns near the waterway, and a large fleet of motor vehicles is maintained for this work.

We are indebted to the Aire and Calder Navigation for the information contained in this article.

Puzzle Your Sharp-Eyed Friends

More Magic for Amateur Wizards

By Norman Hunter (From Maskelyne's Mysteries)

An amateur conjuring entertainment very often suffers from a lack of showy apparatus and is thus apt to be compared unfavourably with a professional show, although the tricks performed may be just as clever. I am therefore going to start off this year by describing a big and quite sensational trick, the apparatus for which can easily be made by any handy man.

THE VANISHING LAMP

The lamp is a large affair with a bulky bowl and a wide spreading silk shade. It stands on a thin tray. The conjurer throws a cloth over the lamp, carries it forward, and says that he is going to put the lamp out. "I don't mean just put the light out" he explains. "I am going to put the whole lamp out. Watch. Go!"

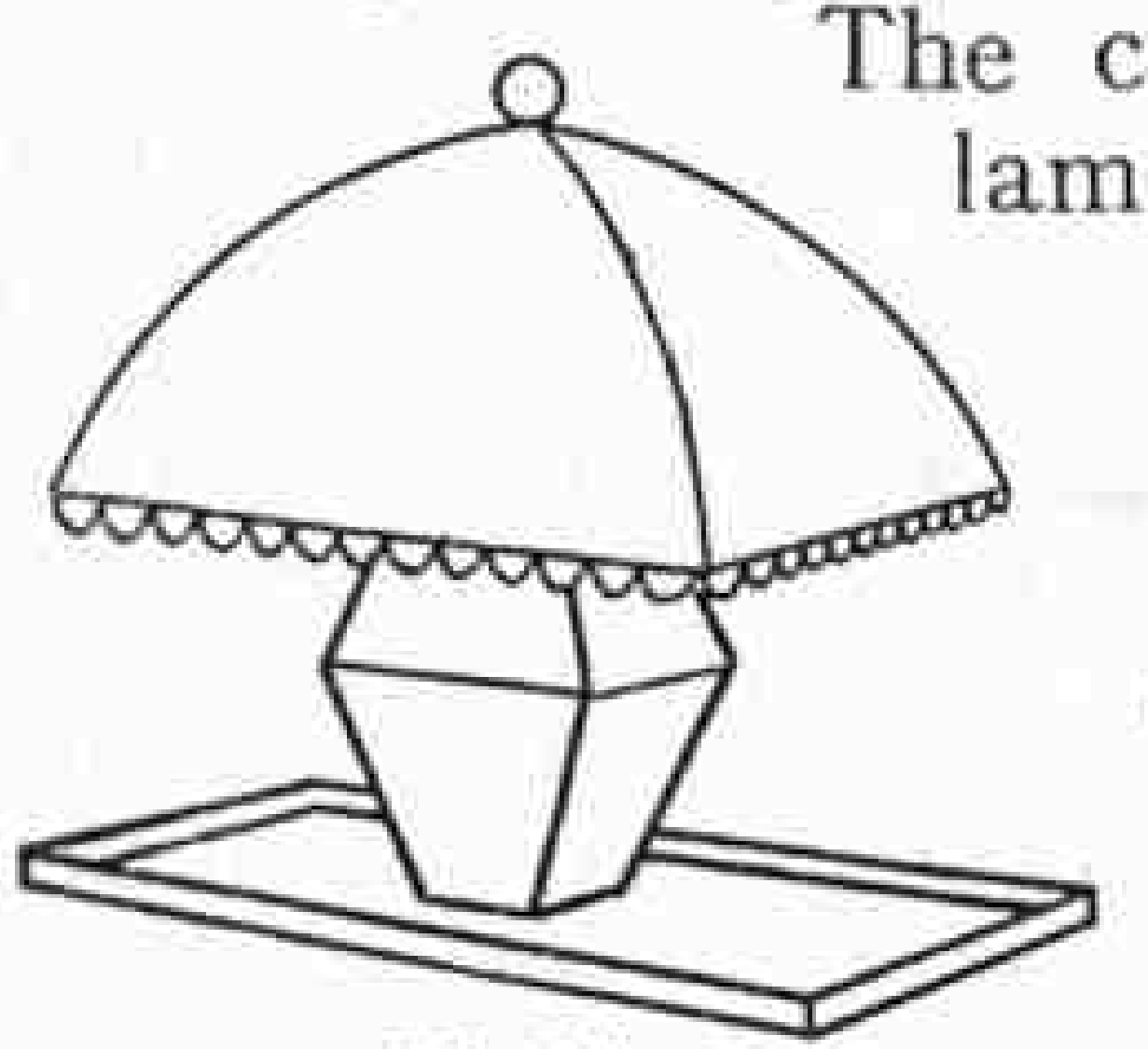


FIG. 1

The Lamp as the audience sees it

As he says these words the light goes out and the cloth collapses. The lamp has vanished!

The Secret. The body of the lamp is made from one of those collapsible lanterns made of metal frames hinged together and filled in with gelatine. This is fastened permanently to the centre of a square tray large enough to accommodate the lantern in its collapsed state. The sides of the lantern are painted some bright colour. To the top of the lantern is fastened a piece of thick cardboard of such a size that it will fit snugly into the tray. The cardboard is painted dead black underneath and to match the surface of the tray on top. Fasten the cardboard to the top of the lantern while the lantern is folded.

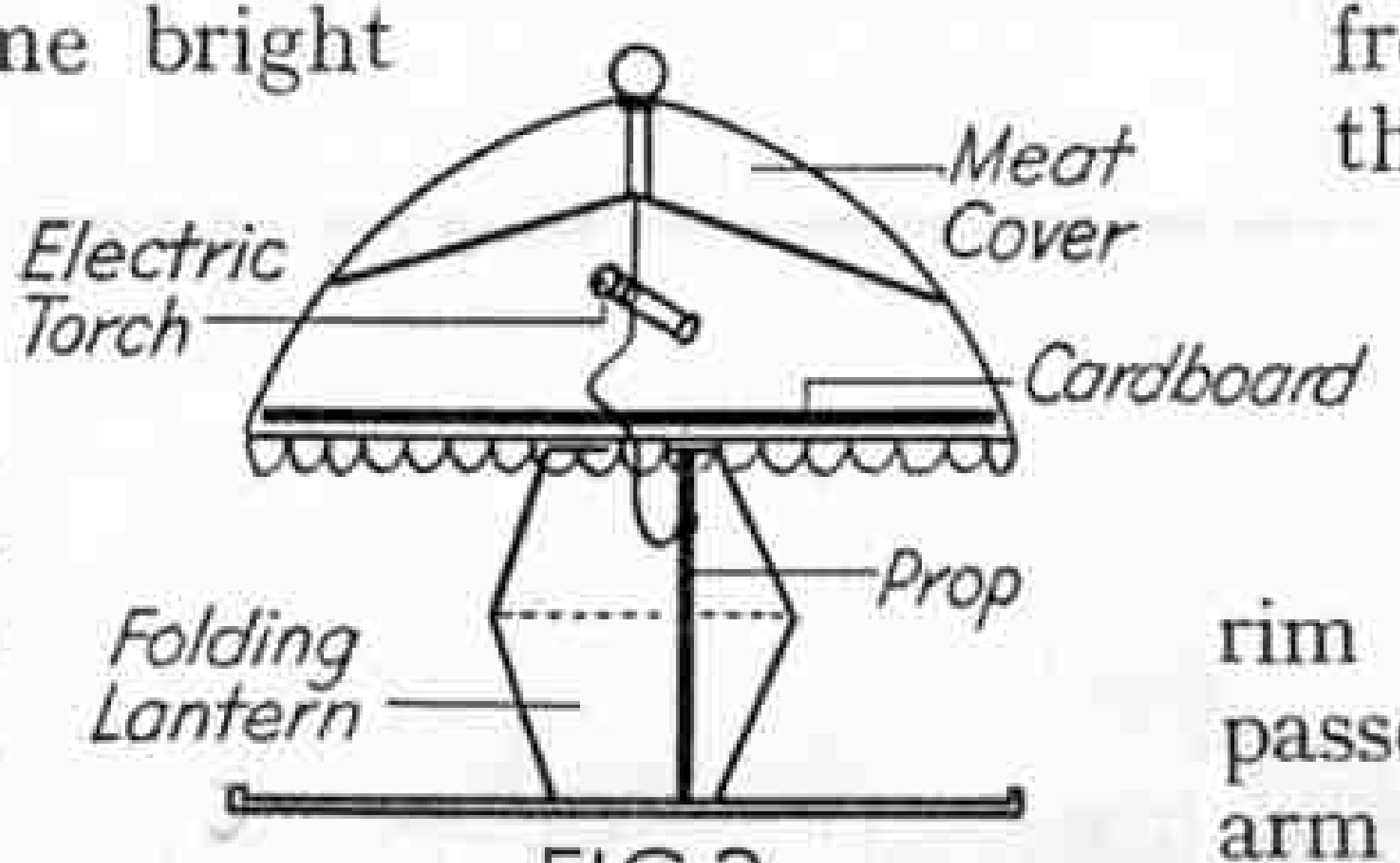


FIG. 2

How the lamp is made

There is a hole in the top of the cardboard, and through this a length of stick is inserted and used as a prop to keep the lantern open.

The lampshade is a meat cover of the umbrella type that can be bought at Woolworths. Take the gauze off and cover it with coloured silk, then add fringe round the edge. To the centre of the cover, on the inside, tie the stick that props up the lantern body, leaving a fair amount of slack, and fix a small pocket electric torch to the shade.

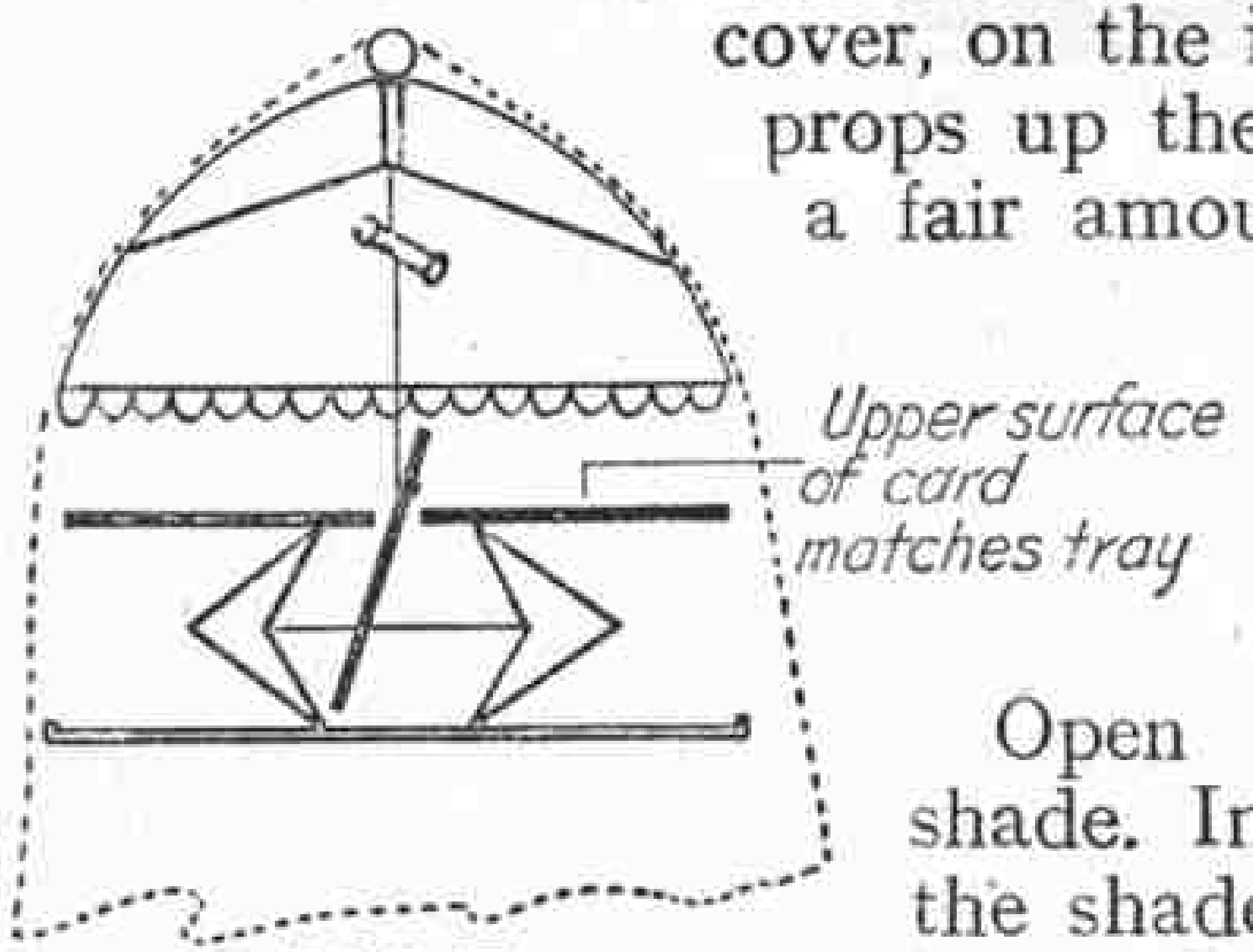


FIG 3

The lamp collapsing into the tray

You are now ready to perform the illusion.

Open the lantern and the shade. Insert the prop and rest the shade squarely on the cardboard. If it is carefully adjusted the lamp will look most realistic and quite solid. The cloth used should be big; about 4 ft. square, and of a light but not too transparent material. Throw it over the lamp. Hold the top of the shade with your left hand and put your right hand under the cloth. Pull the shade forward a little and you will pull out the prop, allowing the lantern to collapse. Your right hand steadies it and prevents it from dropping with a crash. Now walk forward carrying what appears to be the lamp, but which is really only the shade. At the right moment switch off the torch, press the knob on top of the shade, and the shade will close up, leaving the cloth hanging from your fingers as if it were empty. Figs. 1 to 4 will make the details clear.

Now for a version of one of the most popular of all tricks.

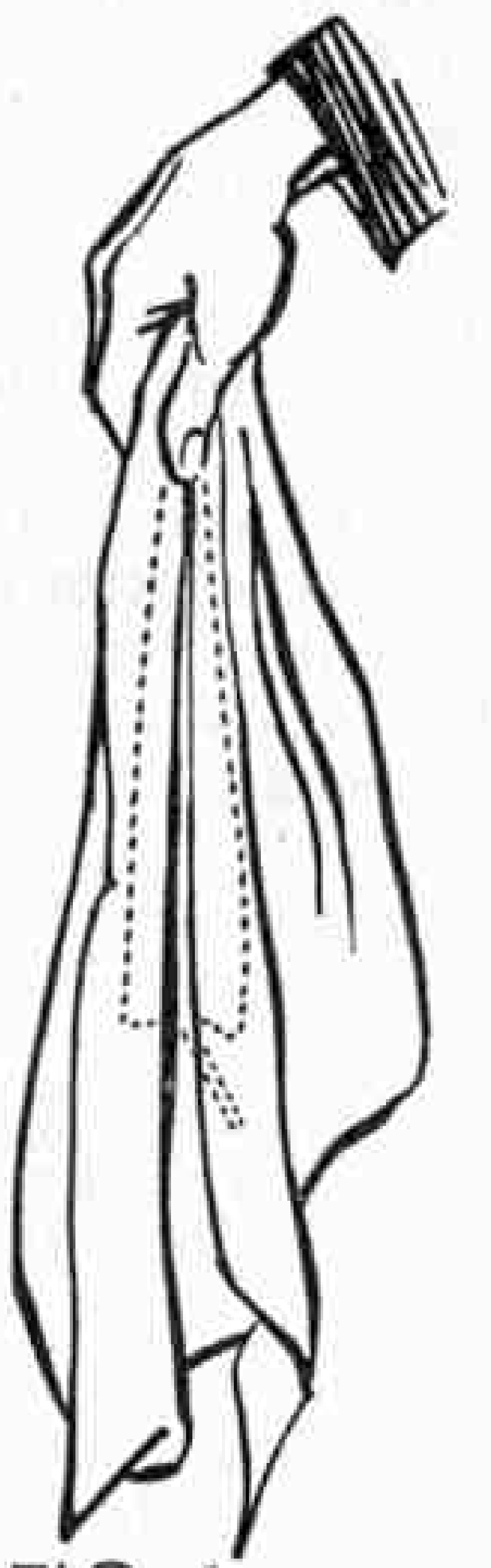


FIG. 4

The cloth after the lamp has vanished

CATCHING MONEY IN THE AIR

The method used by professional conjurers for this effect involves a number of difficult sleight of hand passes. Here is a nice easy way to do the trick.

You sit in a chair and catch coins one at a time from the air, dropping them into a brass bowl on a table in front of you. At the finish you pour out the coins in a shower on the table.

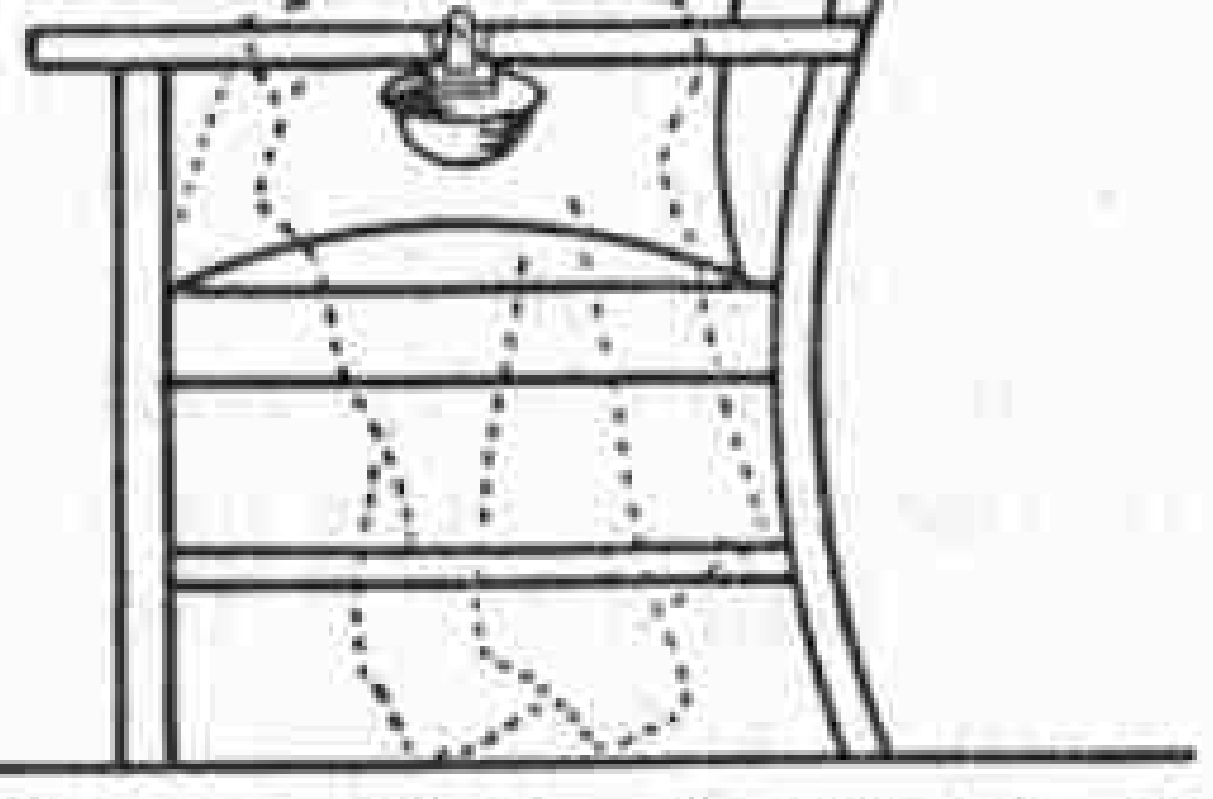
The Secret. There are two bowls. They need not be alike, but they should both be of metal. One bowl, the one the audience know nothing about, has attached to its rim a "bulldog" letter clip. By means of tape passed through this clip the bowl is tied to the arm of a chair on the outside. This chair is placed sideways to the audience, with the bowl on the side furthest from them. A cloth is draped over part of the chair to hide the bowl (Fig. 5).

When you begin the trick you have concealed in your left hand as many coins as you can comfortably hold. You also have one coin in your right hand. The coins in your left hand can repose till wanted in your trouser pocket and you can secure them by putting your hand in your pocket casually while you are telling the audience about the trick. The coin for your right hand can rest on the right arm of the chair till wanted.

Seat yourself in the chair and hold your single coin clipped in the curved fingers of your right hand (Fig. 6). Your left hand, with the other coins, hangs quite naturally over the arm of the chair, just above the hidden bowl.

To catch a coin, make a grabbing movement in the air and push the coin to your finger tips

FIG. 5



Chair with bowl attached. Dotted lines show cloth to conceal bowl

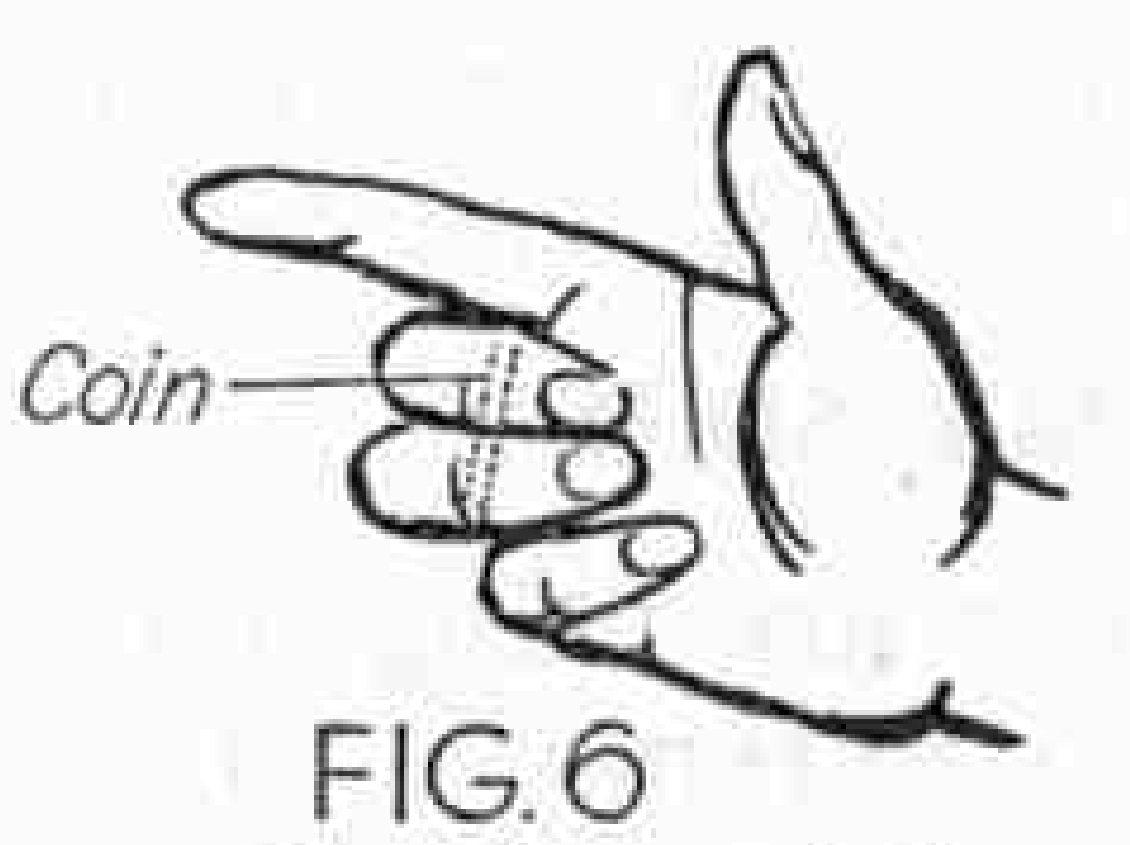


FIG. 6
Coin Concealed

with your thumb (Fig. 7). It is a perfectly easy movement and looks exactly as if you had caught a coin. Apparently drop the coin into the bowl on the table. Actually, however, draw the coin back behind your fingers again (Fig. 6) and drop one of the coins from the other hand into the bowl.

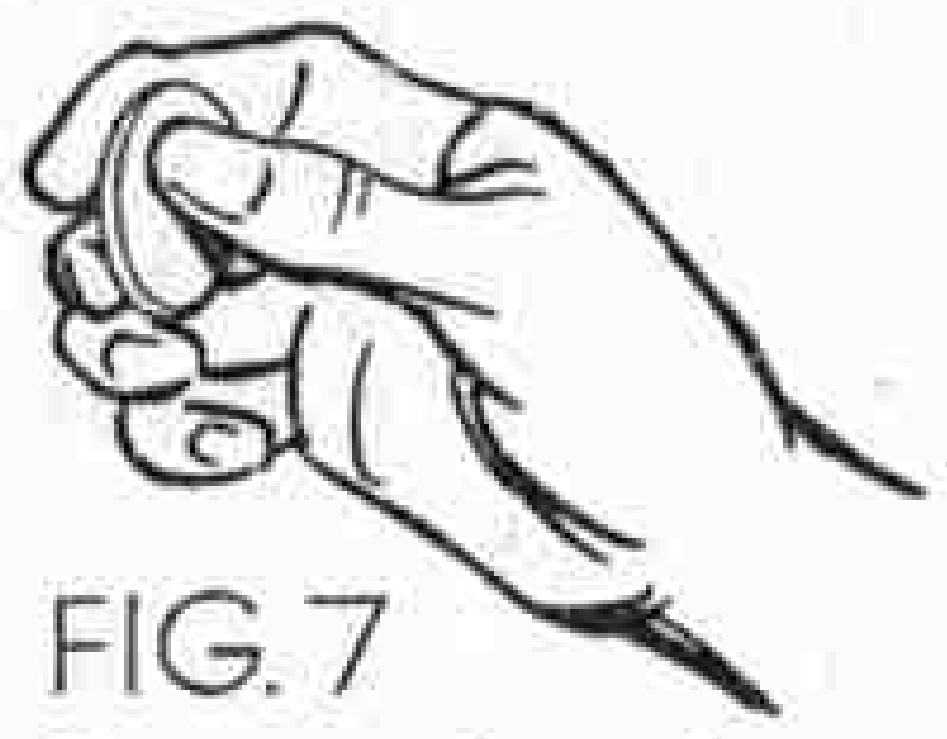


FIG. 7
Coin produced

Continue in this way, catching coin after coin and dropping one each time from your hidden store. If you time your movements nicely the illusion of coins being caught and dropped into the bowl on the table will be perfect.

You will notice that I have left out one important detail. The bowl on the table is empty. How can you pour out of it the coins you have apparently dropped in?

There are several ways of doing this. You can introduce a pile of coins into the bowl under cover of wiping it out with a cloth before you begin the trick, the coins being concealed in a fold of the cloth. Or you can have a duplicate bowl containing the coins under a crumpled cloth on the table. Show your visible bowl to be empty. Put it behind the cloth, at the same time picking up the cloth and taking it away with the empty bowl inside. This leaves the bowl of coins on the table, but as the audience do not know what is coming they will not suspect any change has been made.

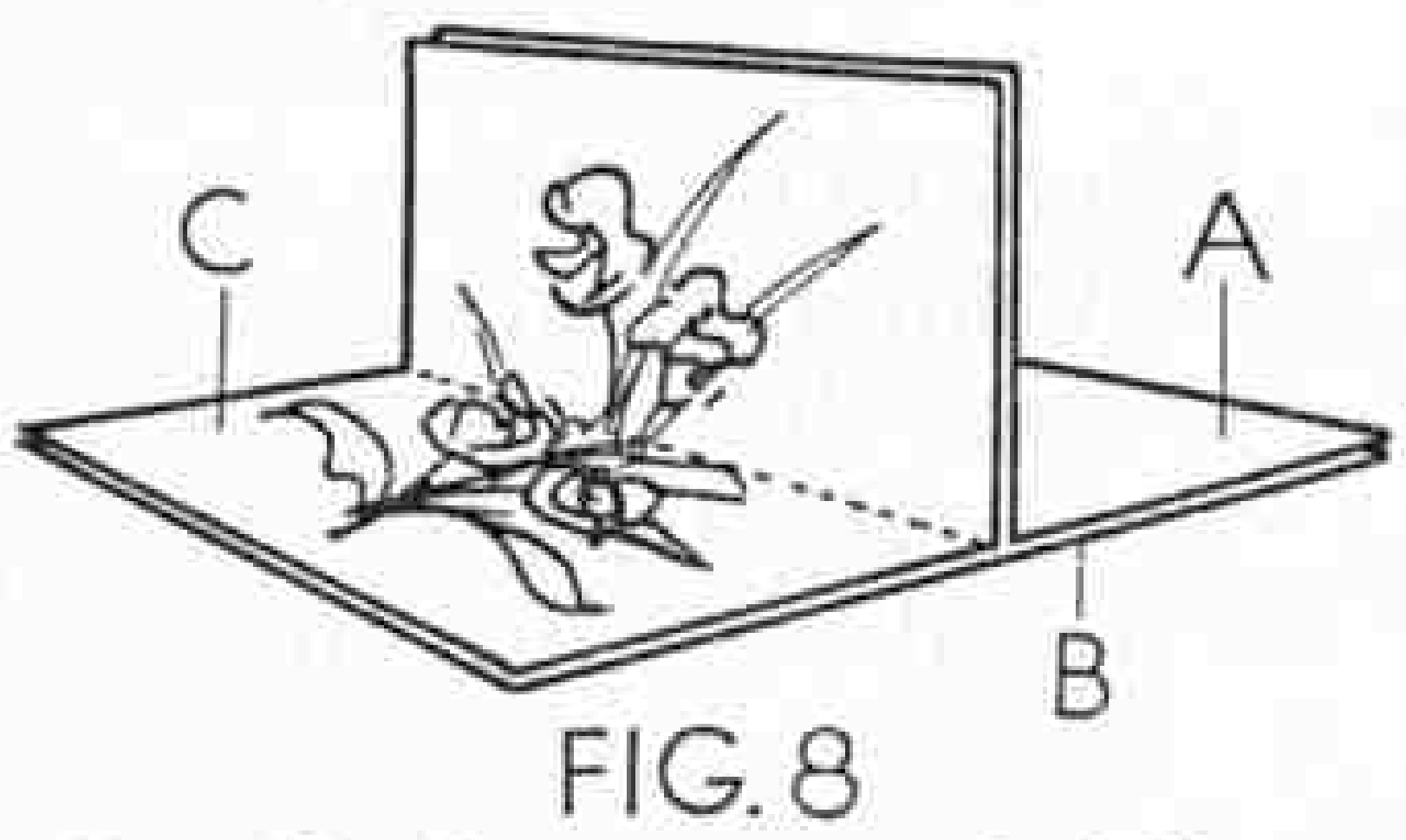


FIG. 8
How the three pieces of cloth are stitched together

Here is another showy trick.

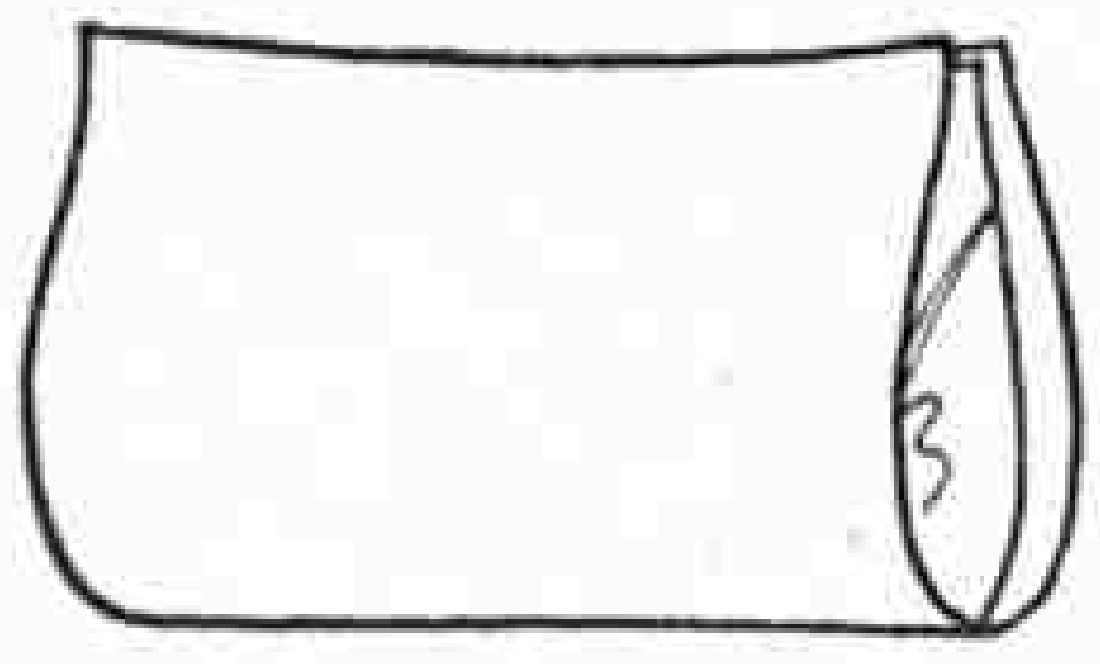


FIG. 10

NECROMANTIC NEEDLEWORK

You show a piece of plain material on both sides, also a number of skeins of differently coloured embroidery silk. Folding the cloth into a sort of bag, you drop the silk inside, but at once shake out the cloth, when the audience see that the silk has embroidered itself into a beautiful design on the cloth.

The Secret. To make the cloth you will need three pieces of material, preferably a dark colour. Each piece of material is the same size and shape. A good size is 18 in. long by 12 in. wide. On one of the pieces persuade a lady friend to embroider a design of flowers, or anything else that takes her fancy. Now have the three pieces of material sewn together as shown in Fig. 8. A, B and C are the three pieces of stuff, C being the one with the embroidery on. You will see that the reverse side of this piece is covered with the other two pieces so that the stitches do not show through. The three pieces of material are sewn together round the edges and across the centre.

If you now hold up the prepared cloth by the edge marked A (Fig. 8), the flap will cover the embroidery. But if you lift the flap and hold the top edge of it with the edge of A, the cloth appears embroidered.

To perform the trick, first show some skeins of silk of the same colours as the embroidery. Show the cloth on both sides, holding it as shown in Fig. 9, with the flap covering the design. Lay the cloth on the table and put the skeins of silk on it. Now fold the cloth over like a bag and pick it up. This time hold it as shown in Fig. 10, gripping the edge of the flap and the top edge of the cloth together between first finger and thumb, while the second finger holds the lower edge of the cloth. Give the cloth a shake and let go of the front edge. This will fall, revealing the embroidered design (Fig. 11); but the loose skeins will remain hidden between the flap and the top half of the cloth.

This is one of those useful tricks that can be worked backward. For instance, instead of producing the design from the silks, you could start with the design showing, give the cloth a shake, let go of the flap, which would fall, and the embroidery would apparently fall off the cloth in the form of loose silk. If you do the trick this way I suggest that instead of skeins of silk you use a mass of loose silk.

When you are presenting the trick you might say that you call it necromantic needlework, but really it is a kind of needless work. There isn't any work involved and no needles are needed.

THE BALL AND THE PLATE

This is a very easy trick, but none the less effective for that. You show a soup plate, draw back your sleeves and lay the plate upside down on the table. Taking a ball, you make it disappear, and when the plate is lifted the ball is found underneath.

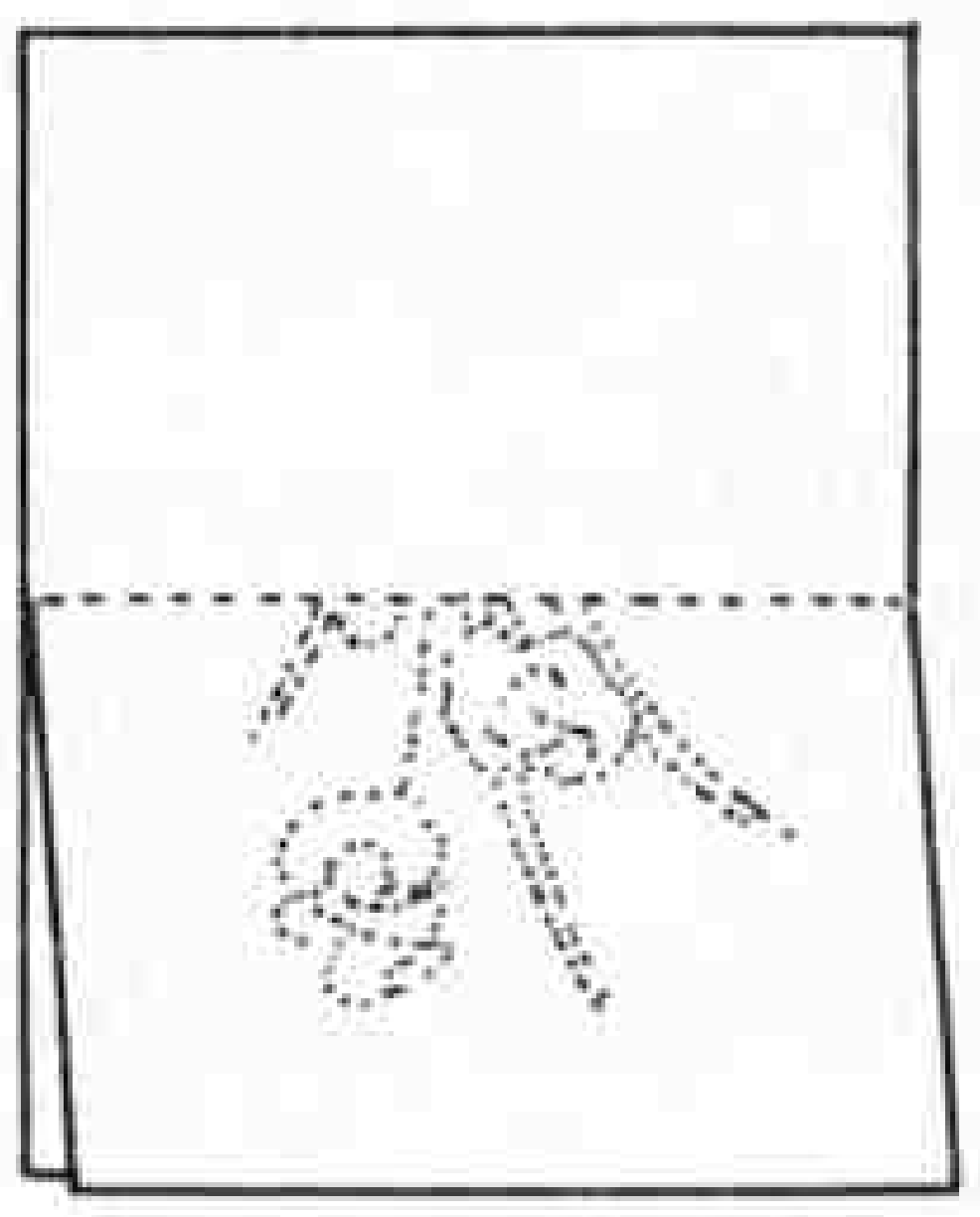


FIG. 9

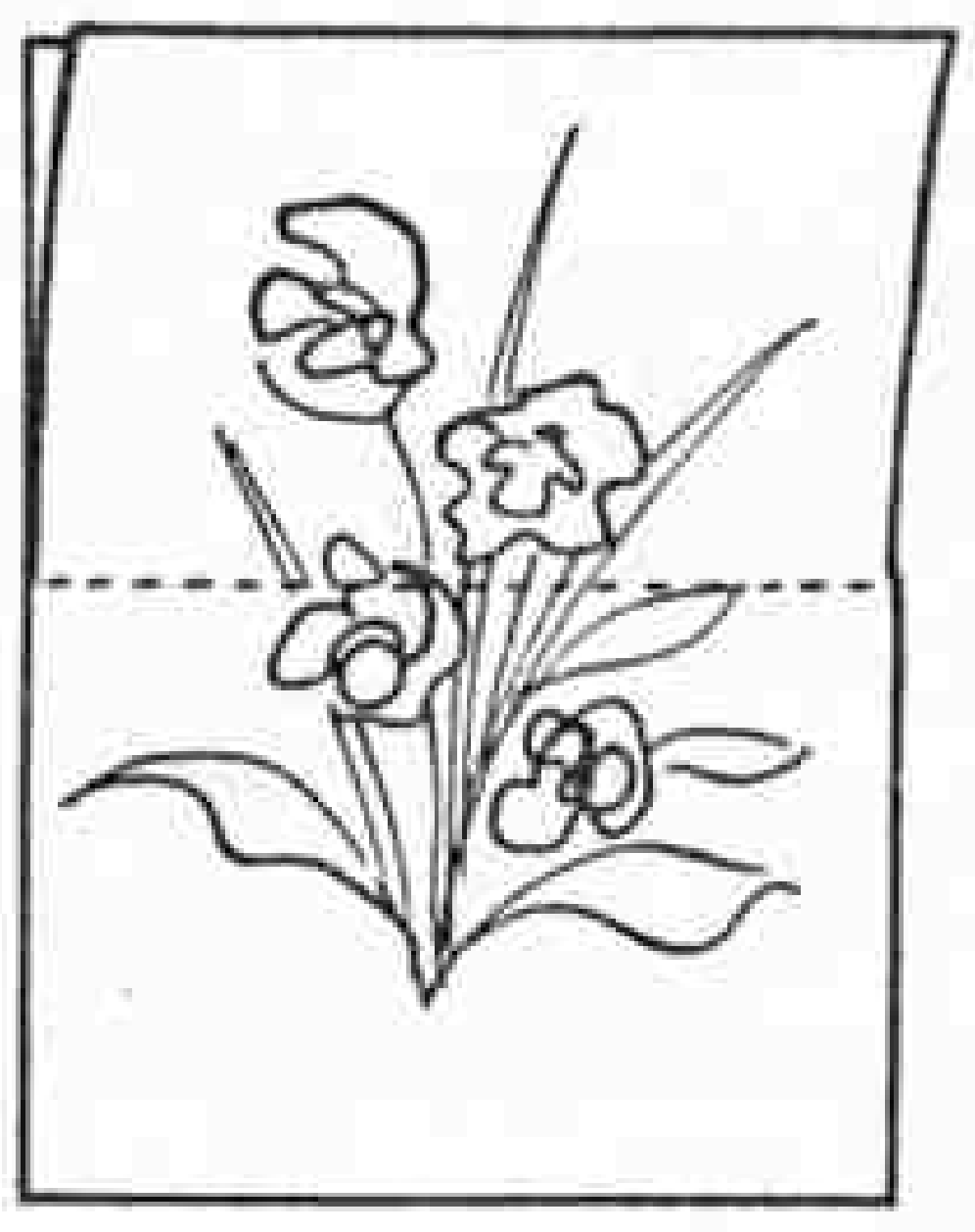
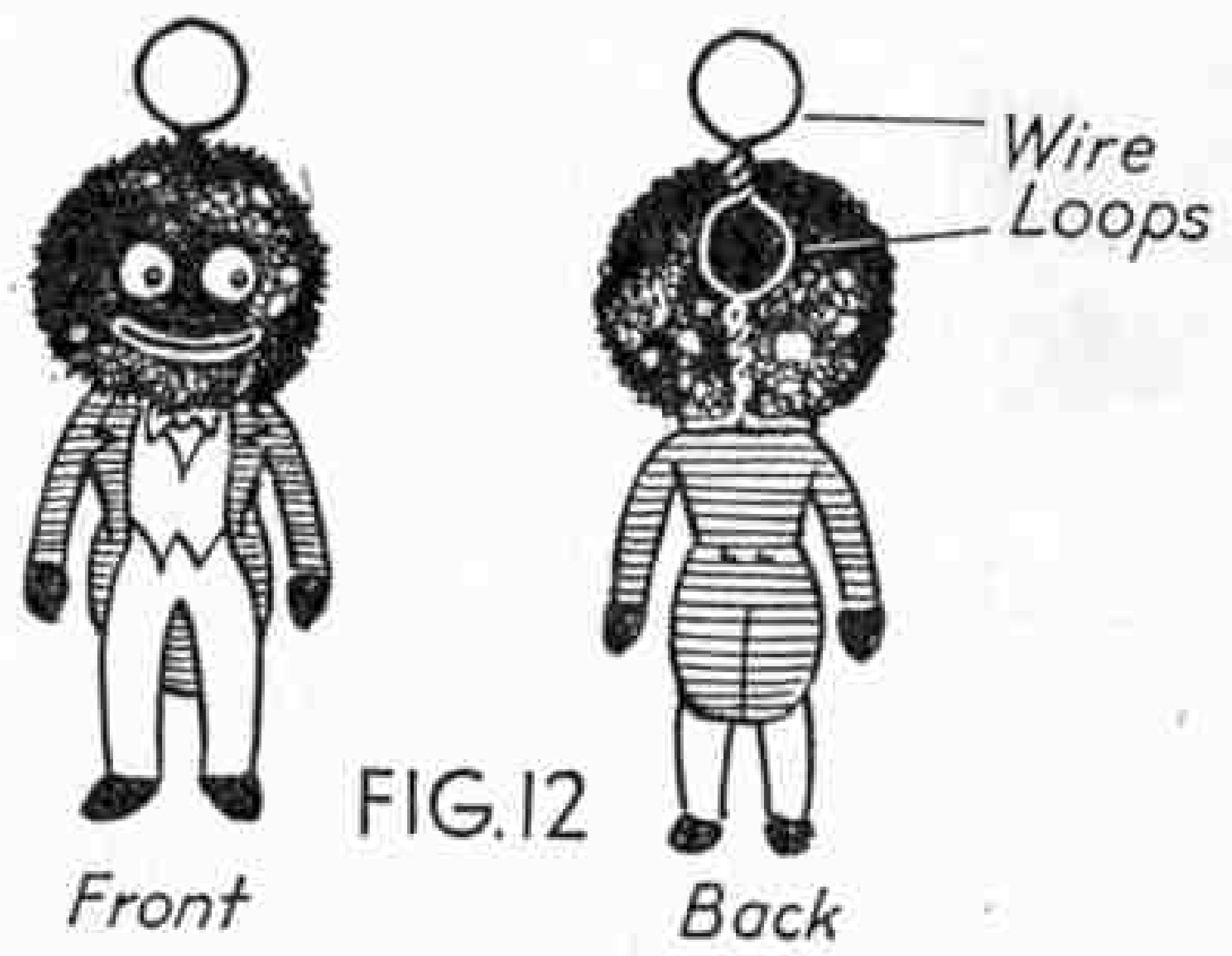


FIG. 11

The Secret. In the act of drawing back your sleeves you practically do the trick. The best sort of ball to use is one of those solid rubber golf balls. One of these you place under your left armpit where you can hold it concealed by pressure of your arm. Show the plate. Hold it in your right hand, and with the left hand draw back the right sleeve. Take the plate in the left hand and with the right hand draw back the other sleeve. You do this by placing the fingers under the arm and the thumb above, close up to the shoulder. You will find this brings the concealed ball naturally into your hand. Now place the plate in your right hand and so over the ball. Lay the plate on the table with the ball underneath.

A good way to vanish the ball is as follows. Make your right hand into a fist. Take the ball, a duplicate of the one you have introduced under the plate of course, and stand it on top of your fist. Now apparently grasp the ball with your left hand. As your fingers curl round it, however, the right hand is slightly opened and the ball allowed to fall inside, where it is held in the curled fingers, much in the same way as the coin in the money



Front FIG. 12 *Back*

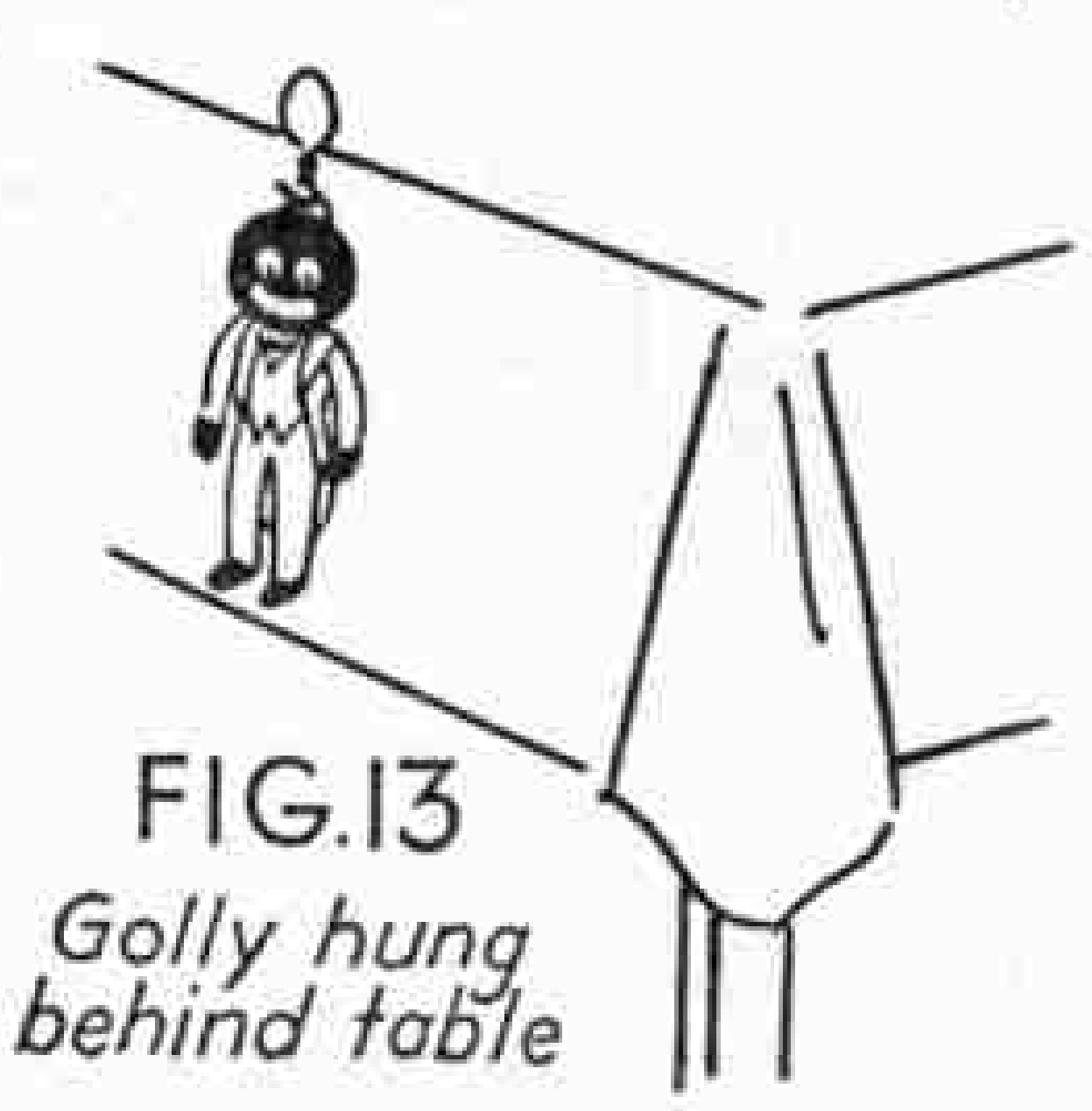


FIG. 13
Golly hung behind table

catching trick already described. Drop your right hand casually to your side, and carry your left hand away closed as if containing the ball. Make a crumbling movement over the plate, show that the ball has gone, lift the plate, and reveal what is apparently the same ball, under the plate.

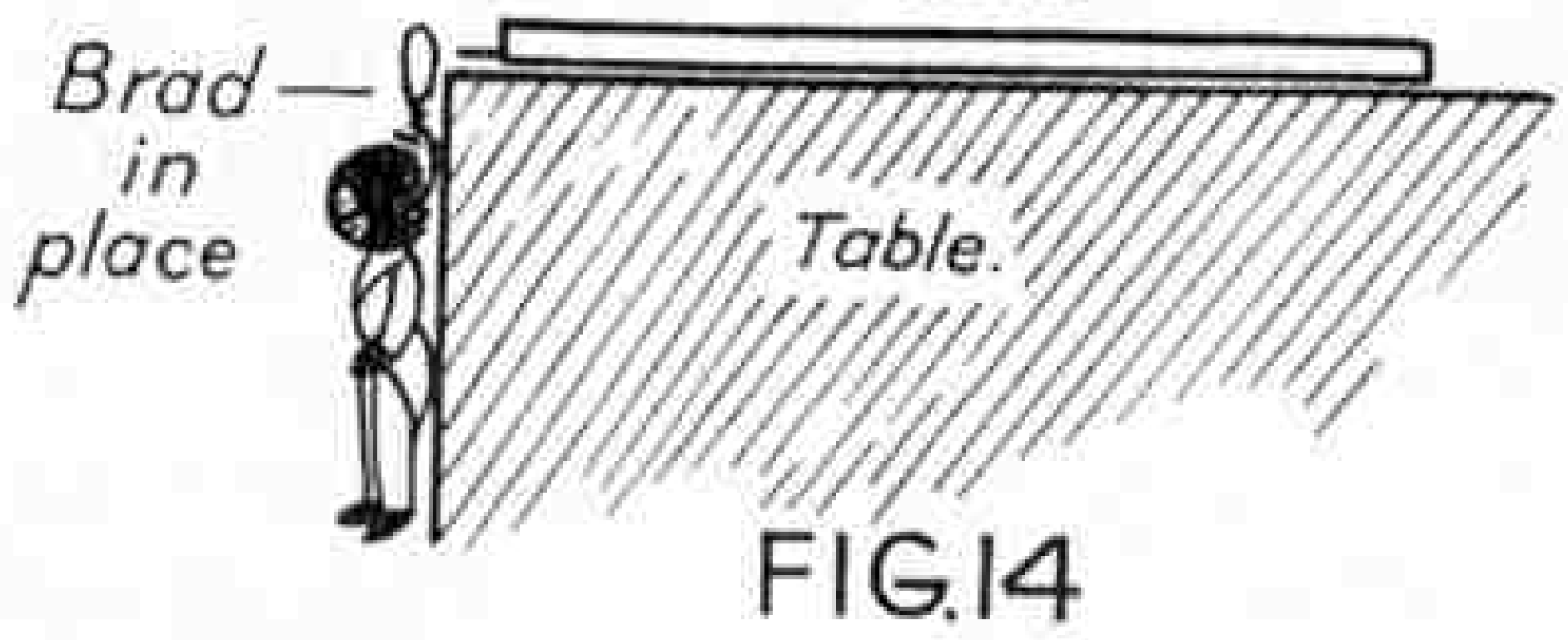


FIG.14

You can repeat this trick if you like. Pick up the plate with your left hand and place it in your right, over the ball concealed there. Pick up the visible ball with your left hand and put the plate down, leaving the ball underneath as before. This time, however, I advise you to use a different method of vanishing the visible ball. Have the cloth on your table pinned up at the back to form a pocket. Put the ball down near the back edge of the table. Draw your sleeves well back and apparently pick up the ball with both hands. Actually you cup your hands round the ball and sweep it off the back of the table into the pocket, bringing up your hands as if holding the ball. The rest is simple.

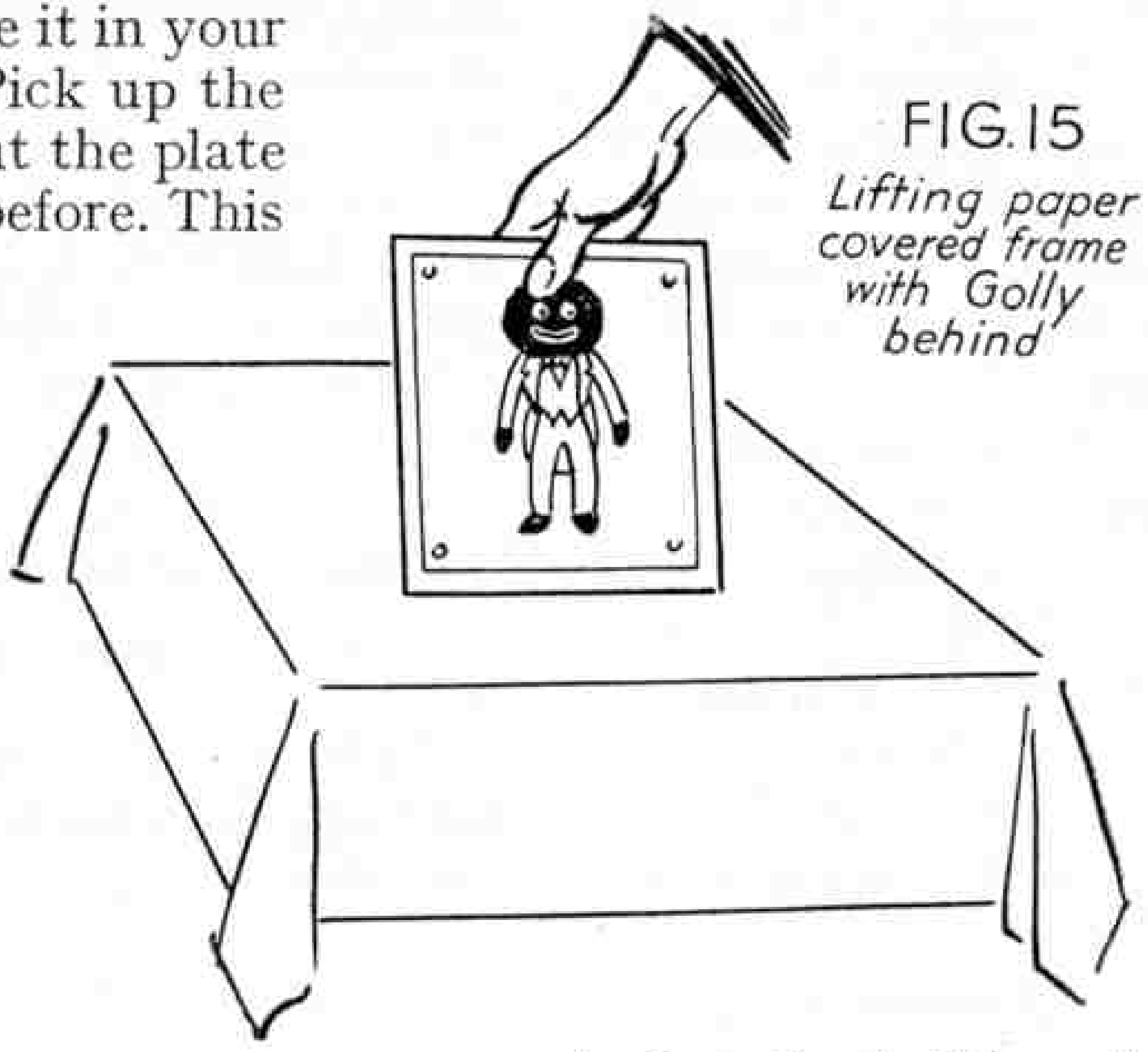


FIG.15
Lifting paper covered frame with Golly behind

OH GOLLY!

This is not only the sort of exclamation an audience might be expected to make when they see this trick, but it also indicates the subject of the experiment. Briefly, you pin a sheet of paper over a thin frame, draw a gollywog on the paper, burst the paper and produce an actual gollywog from the drawing.

The Secret. The frame is unprepared. Just a thin picture frame without glass or back and measuring about 12 in. by 10 in. A small brad is driven into the centre of the top of the frame.

To the gollywog attach a piece of florists wire, twisted so that two loops are formed, one above the other as shown in Fig. 12. Drive a headless brad into the back of the table. Hang the gollywog on this brad by the lower loop (Fig. 13).

To perform the trick, show the frame and, if you wish, have it examined. The presence of the brad will excite no comment unless someone scratches himself on it. Lay the frame on the table with the bradded end to the back, and see that the brad points directly towards the upper loop on the gollywog (Fig. 14), which should project above the table. Pin paper on to the frame. Lift the edge of the frame nearest the audience and let them see the reverse side. Lower the frame to the table again, then slide it backward and stand it upright. The edge with the brad scoops the gollywog up behind the frame where it hangs suspended ready to be produced as soon as the drawing has been made (Fig. 15). You need not be an artist to make this drawing, the more crude your sketch the better, because you can then say: "I may not be much of an artist, as you can see by my drawing of this gollywog. But I'm a good magician, as you can see by gollywog himself." Then produce the gollywog.

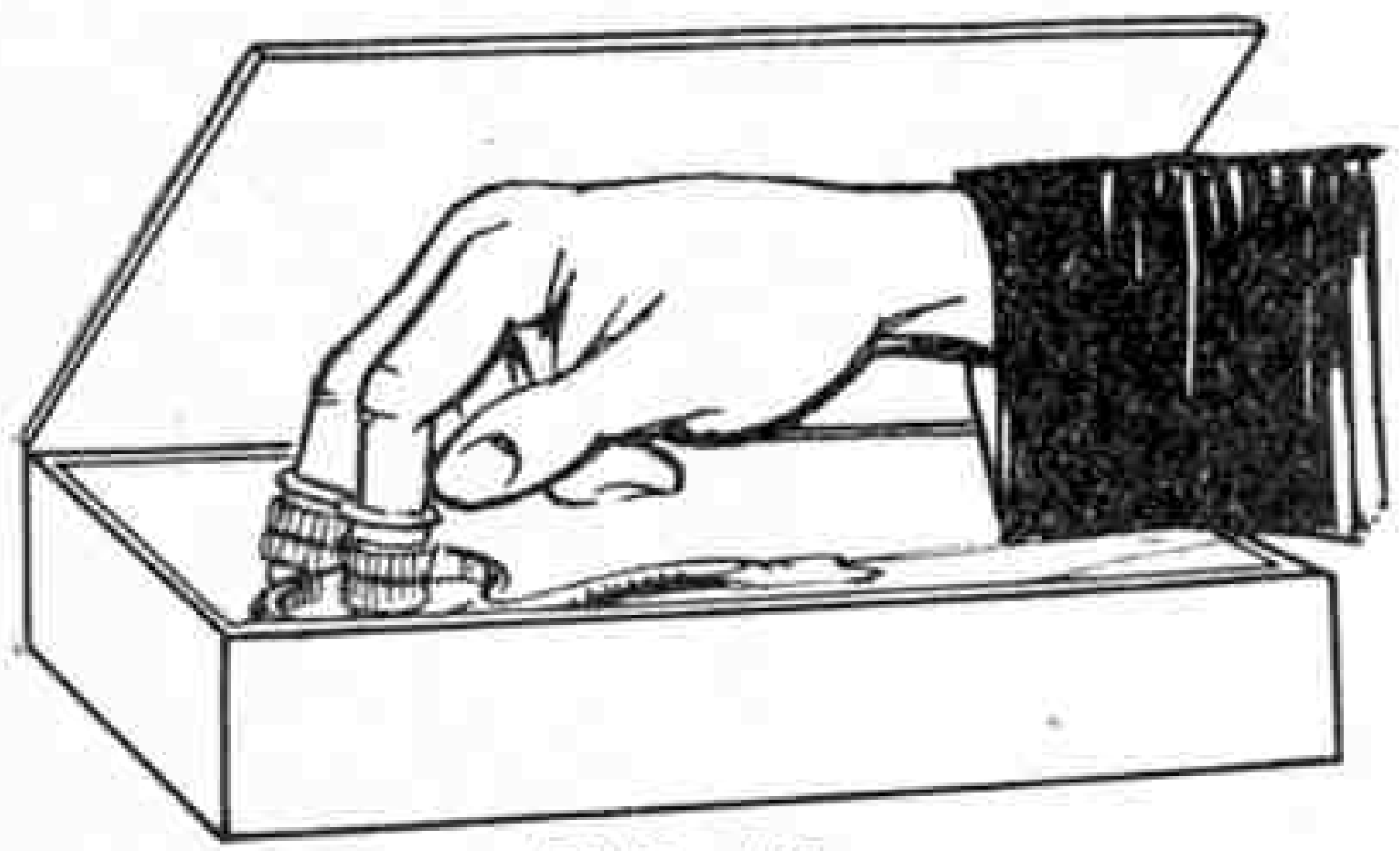


FIG.16
How second finger secures duplicate ribbon on thimble while first finger is picking up the other thimble

THE RADIO SCISSORS

"More and more things are being done by wireless nowadays," you remark. "But I think this will be a new one for you."

From a box you take a length of ribbon and a thimble. You wind the ribbon round the thimble, snap a small elastic band round it, and give the packet to someone to hold. You then take from the box a pair of scissors.

"My radio scissors," you explain. "They cut by wireless. Look."

You make a few snips in the air then ask the person holding the ribbon to unroll it. When he does so he finds it cut into several pieces.

The Secret. You will probably have guessed that the whole ribbon must somehow be secretly exchanged for the cut one. This is how it is managed.

In the box, besides the scissors, ribbon and thimble, is a duplicate thimble, and wound upon it is a similar length of ribbon that has been cut into about four pieces. A small elastic band holds the ribbon round the thimble and the packet is stood in the box with the mouth of the thimble uppermost. The other thimble rests beside it, also mouth upward. It may be stood in one handle of the scissors for support.

Begin by taking out the ribbon. Show that it is one piece, and have it examined if you wish. Now put your right hand into the box and push your first finger into the thimble. At the same time put the tip of your second finger into the thimble that has the ribbon round it as shown in Fig. 16. Bend this finger down into your palm and so conceal the ribbon. Hold up your first finger, and proceed to wind the visible ribbon round it. Put an elastic band round the ribbon to keep it snug.

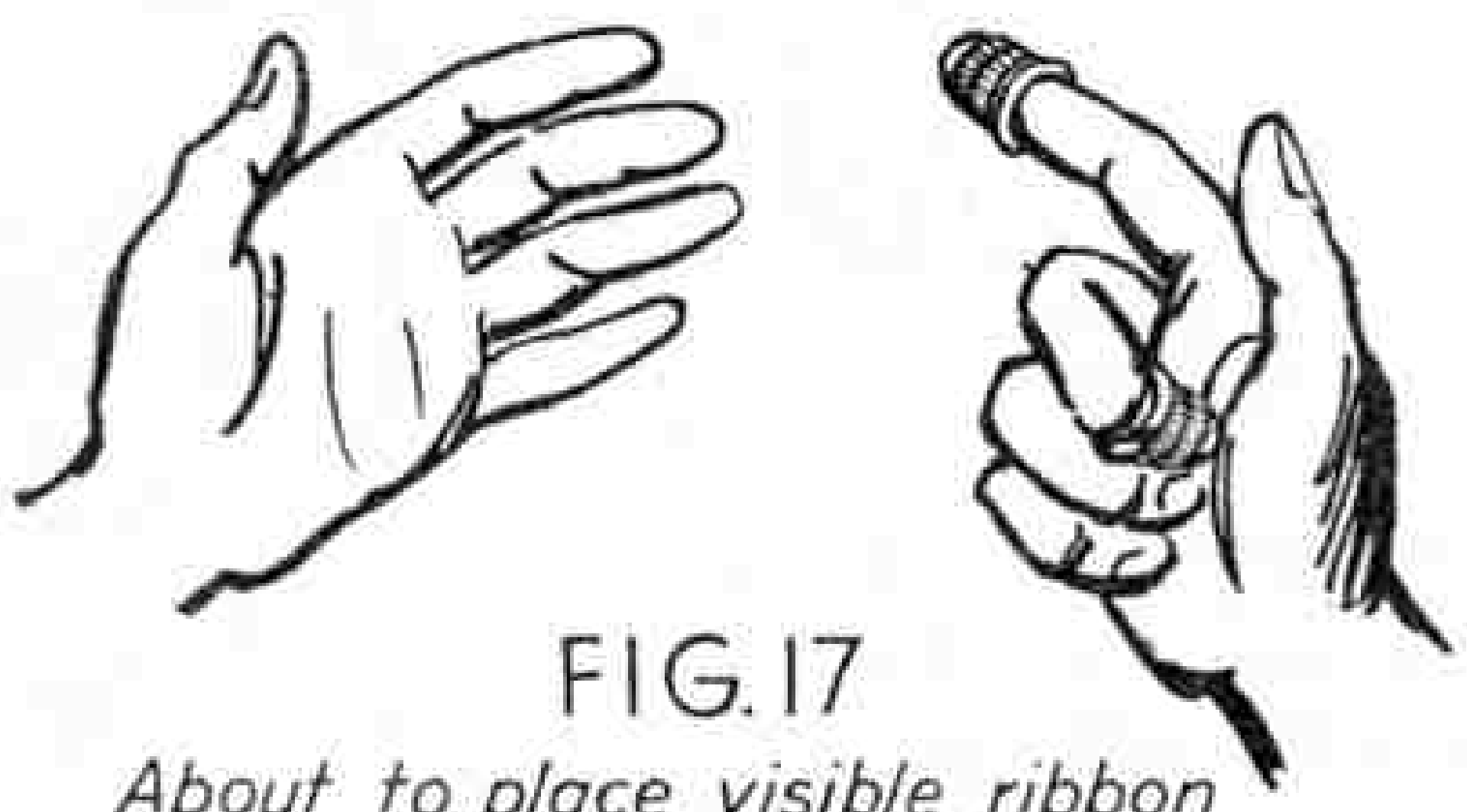


FIG.17
About to place visible ribbon in left hand

When you apparently take this roll of ribbon and the thimble off your finger what you really do is this. Hold your finger out at arm's length (Fig. 17), then bring it round with a swing into your left hand. Under cover of the swinging movement bend down the first finger, and hold up the second finger so that it is the cut ribbon you take off, the other remaining concealed as in Fig. 18. The deception is perfect. Hand the cut ribbon to a member of the audience and leave the other roll in the box when you take the scissors out. At the finish, of course, everything can be examined again.

In conclusion I should like to emphasise that every conjuring trick, no matter how easy, needs to be tried over a few times in private before being shown to even the smallest audience, and every trick needs to be presented in an entertaining fashion. The attention of the audience can be effectively diverted at critical moments in the performance by a few witty jokes and sayings.

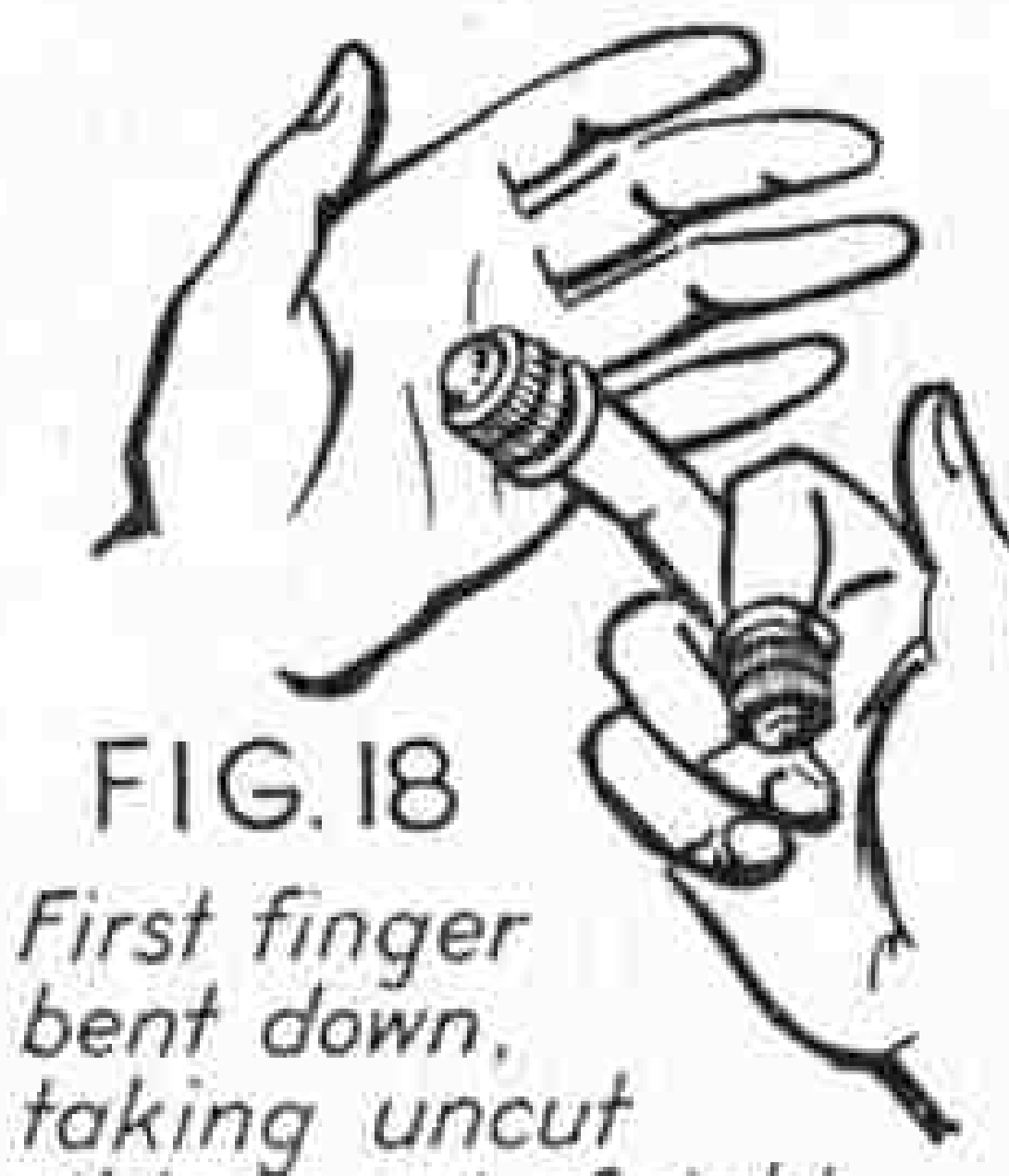


FIG.18
First finger bent down, taking uncut ribbon out of sight. Second finger with cut ribbon is brought up in its place

Puzzles

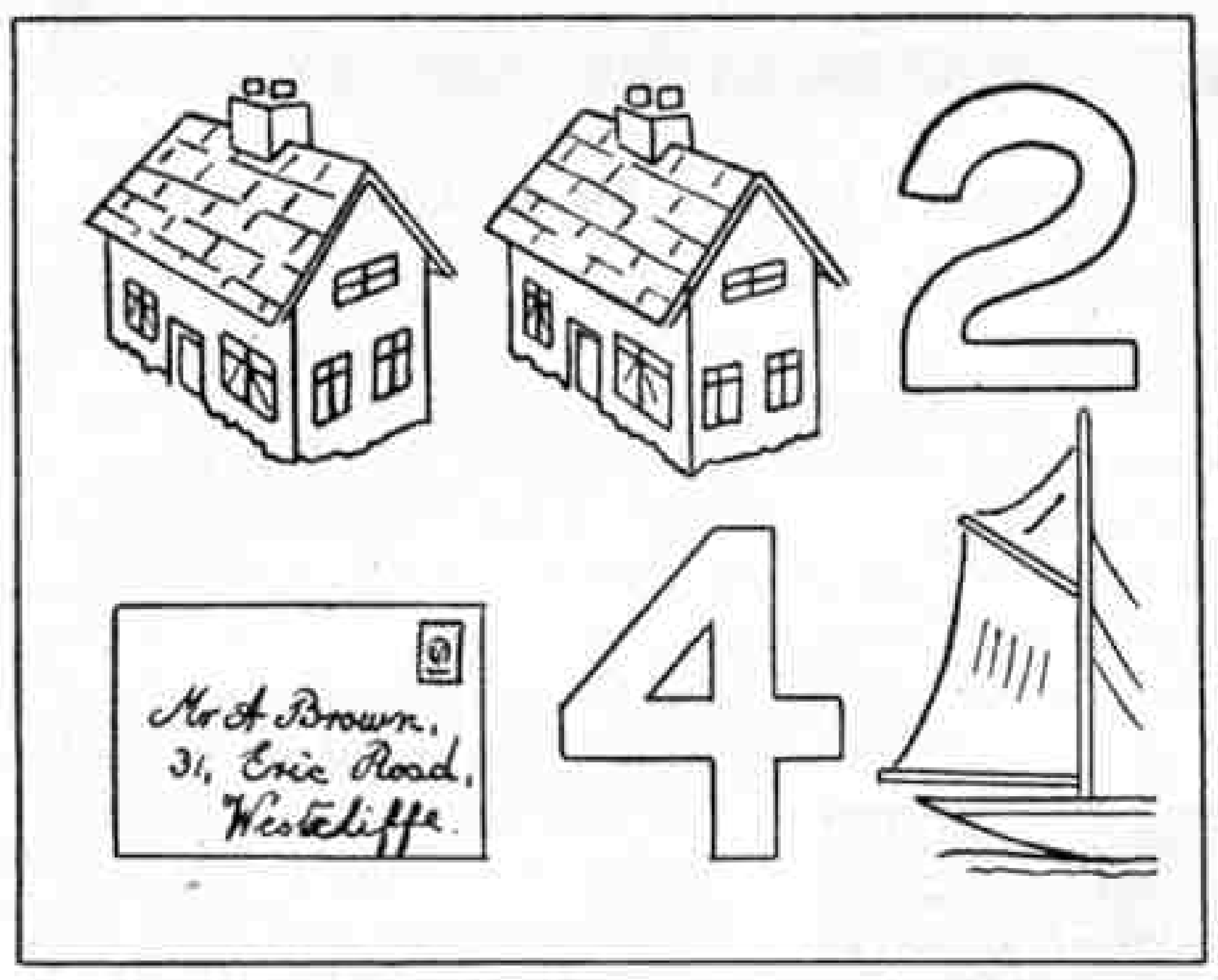


Fig. 1.

Puzzle No. 1

The notice in Fig. 1 is not spelled in the usual manner, but it is quite easy to read. Try it!

Puzzle No. 2

If 12 elephants were standing in single file, all facing the same way, how many of them could say: "My trunk is touching another elephant's tail?"

Puzzle No. 3

In the following composition the letters of some of the words have been replaced by figures. The missing words may be found by means of a 10-lettered keyword, the letters of which are numbered 1234567890. The problem is to find the keyword and then substitute the appropriate letters for the figures.

The 80678757890 of the revelries associated with the festive 614690 undoubtedly 4668676 in harassing 39676 and 396716616 alike. 73161 675076 turn the 39561 upside down—popular as they may be with both 61216—and the 7106890 is felt by people of all 67478906 if they would be 390167 about it, and not seek to 127105471 anything. Personally, I have a strong 097890 that any 127106890 would make the 687547890 unbearable and I have no 3168747890 in saying so!

Puzzle No. 4

If the letters of each of the addresses given below are re-arranged, they will spell two well-known proverbs.

1. Geo. F. L. Brook,
Heath Street,
Cardiff.
2. Mr. Strong,
Saloon Street,
Leigh-on-Sea.

Puzzle No. 5

A gentleman divided 7s. 6d. between two fathers and two sons, each father and each son receiving half-a-crown. How did he manage it?

Puzzle No. 6

A window in a certain house was recently made twice its original size, but without increasing either its height or its width. How was it done?

Puzzle No. 7

Arrange 15 matches on a table in such a pattern that 10 triangles, 9 diamonds and one hexagon are produced.

Puzzle No. 8

Can you cut a piece of paper into four pieces each of exactly the same size, and put them together again so as to form a symmetrical Greek cross?

Puzzle No. 9

When is a black cat most likely to enter a bungalow?

Puzzle No. 10

What word of five letters is never pronounced rightly?

Puzzle No. 11

What is the smallest number of weights, and of what denominations must they be, with which can be weighed any number of pounds from 1 to 63 inclusive?

Puzzle No. 12

What am I?
I have a head and two feet too;
I've seen them so I know it's true.
A bed has got four legs; that's so,
Yet only has one foot, you know.

Puzzle No. 13

Each of the following jumbled words when reshuffled spells the name of a fish:

NOALMS
ELKCEMRA
SEYORT
LINEKW
ECAPIL
OHARC

Puzzle No. 14

A coster wished to pass along a road, across which were three toll gates as shown in Fig. 2. He had no money, so to the keeper of the first gate he said: "If you let me pass I will give you half the oranges on my barrow plus half an orange," and this offer was accepted. At the second gate, and again at the third, the coster made the same offer, and in each case it was accepted.

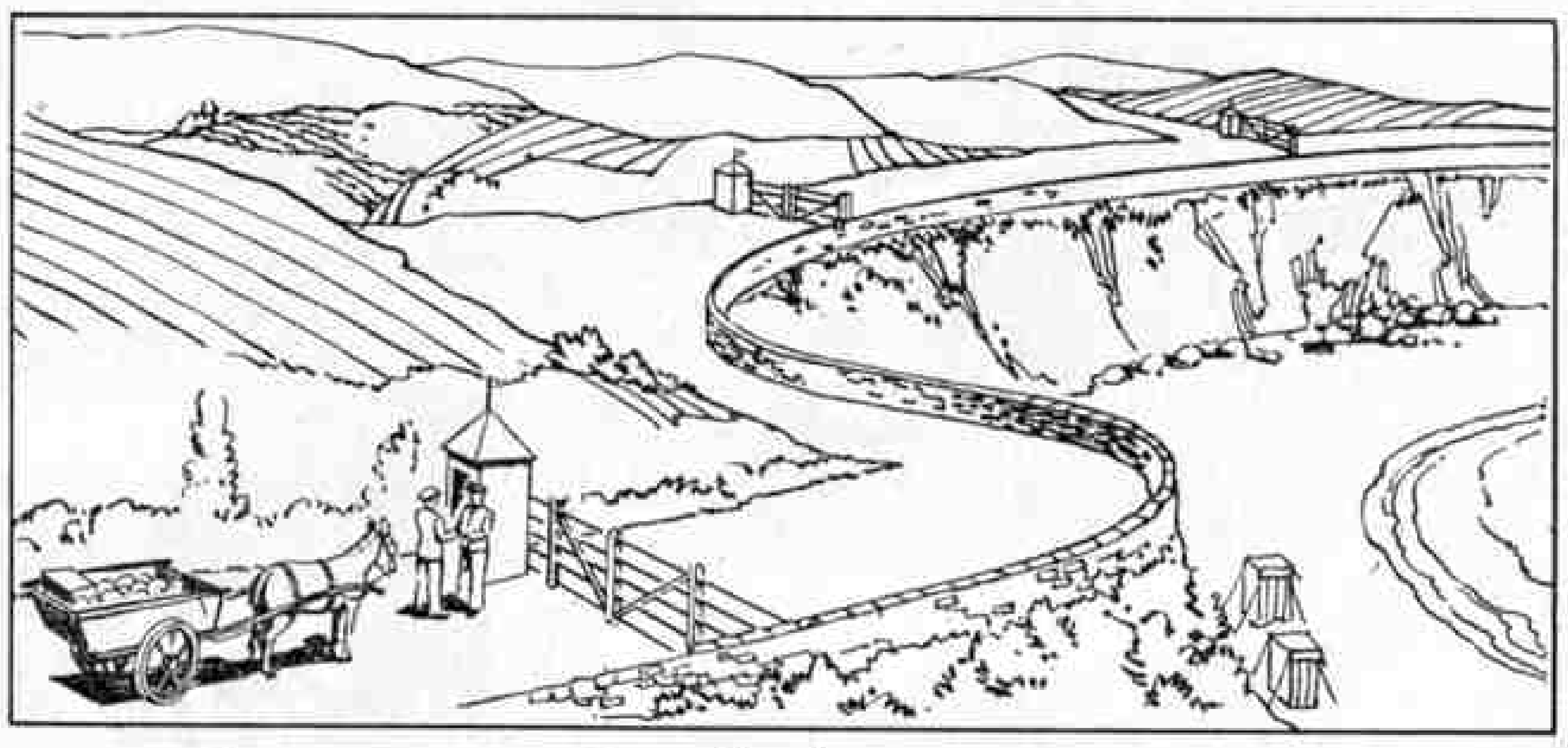


Fig. 2.

After passing the third gate the coster had no oranges left. He had not cut any oranges, and he had only whole oranges to start with. How many oranges had he originally?

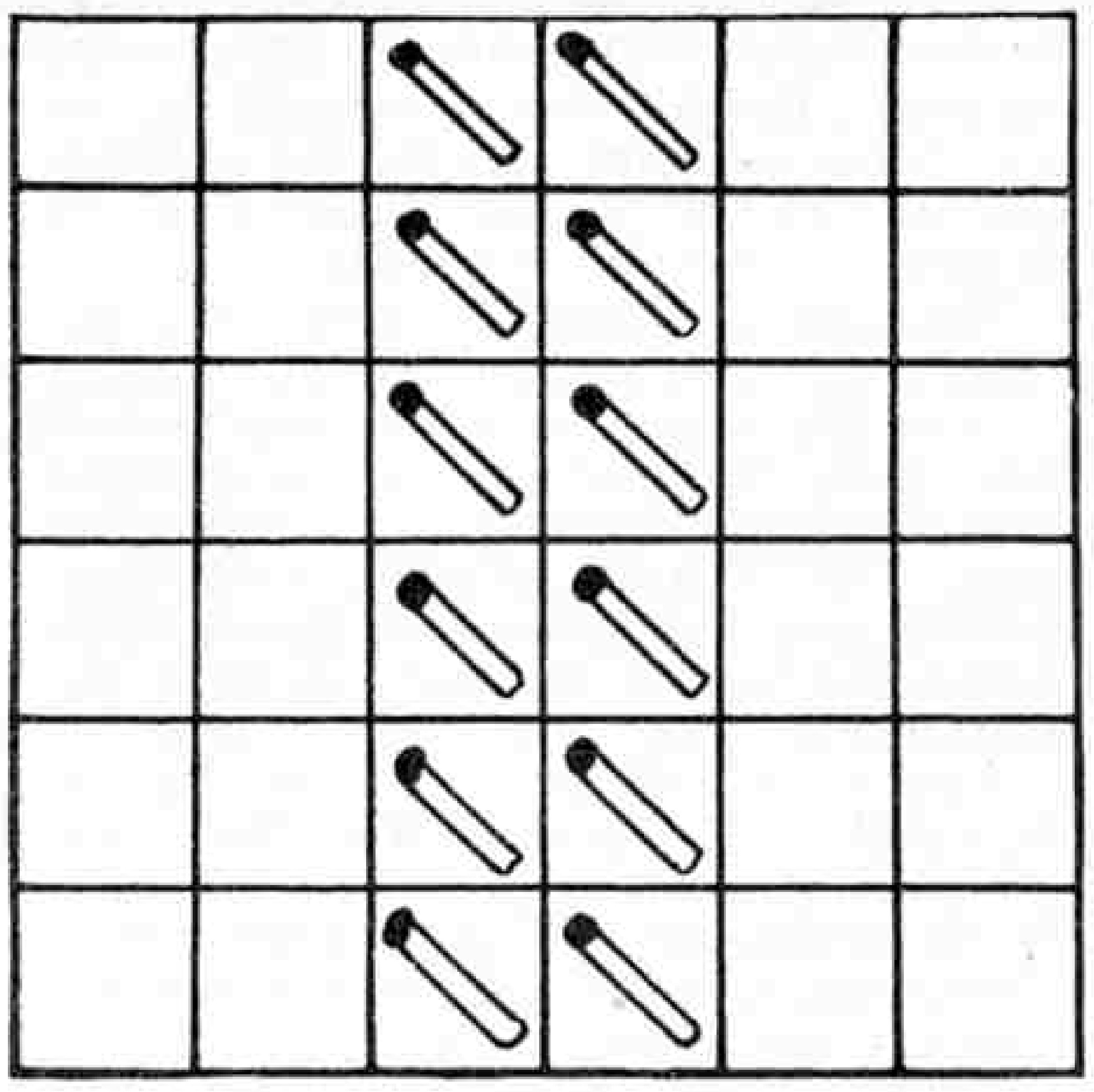


Fig. 3.

Puzzle No. 15

Rule off 36 squares on a piece of cardboard as shown in Fig. 3. Then place 12 matchsticks down the centre rows of squares as illustrated. The problem is to re-arrange the matches so that there are only 2 in any one line, horizontal, diagonal, or perpendicular.

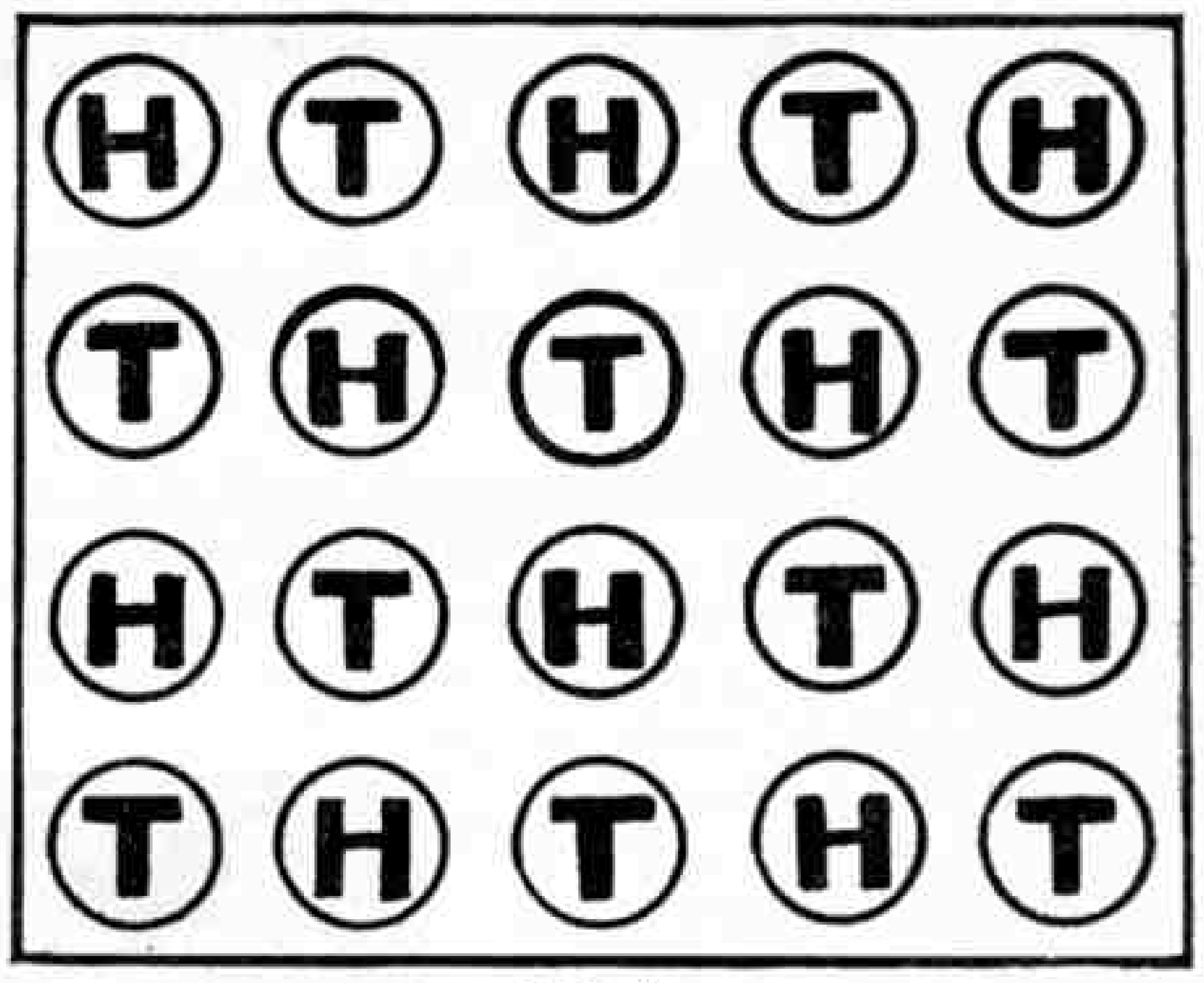


Fig. 4.

Puzzle No. 16

Arrange 20 coins, head and tail upward alternately, in four rows as shown in Fig. 4. Then re-arrange the coins, *in one move*, so that each of the five rows consists of coins either all heads or all tails upward. Several coins will have to be moved, but the changes of position are to be carried out *in one continuous operation without stopping*. No coin must be reversed from head to tail, or vice versa.

Puzzle No. 17

Using 20 matches, form three squares and four triangles in such a manner that when two of the matches are moved six squares but no triangles are produced.

Puzzle No. 18

The officials at a certain Post Office were puzzled on receiving a letter addressed as follows:

Wood
John
Hants.

After a study of the envelope, however, a quick-witted postman was able to solve the mystery. What was his solution?

Puzzle No. 19

Can you decipher the following message, which was sent by a gentleman to his friend:

Rebellion Rebellion
stand
Sir, – you will
that in the year 1877
F–R–A–N–C–E
Laws Laws
Religion
Rebellion Rebellion

Puzzle No. 20

By placing the vowel "I" at the proper points in the following diagram a sentence can be made. The end of a line is not necessarily the end of a word.

B L L S S T
L L L V N G
W T H J M S
M T H N T H
S B G C T Y

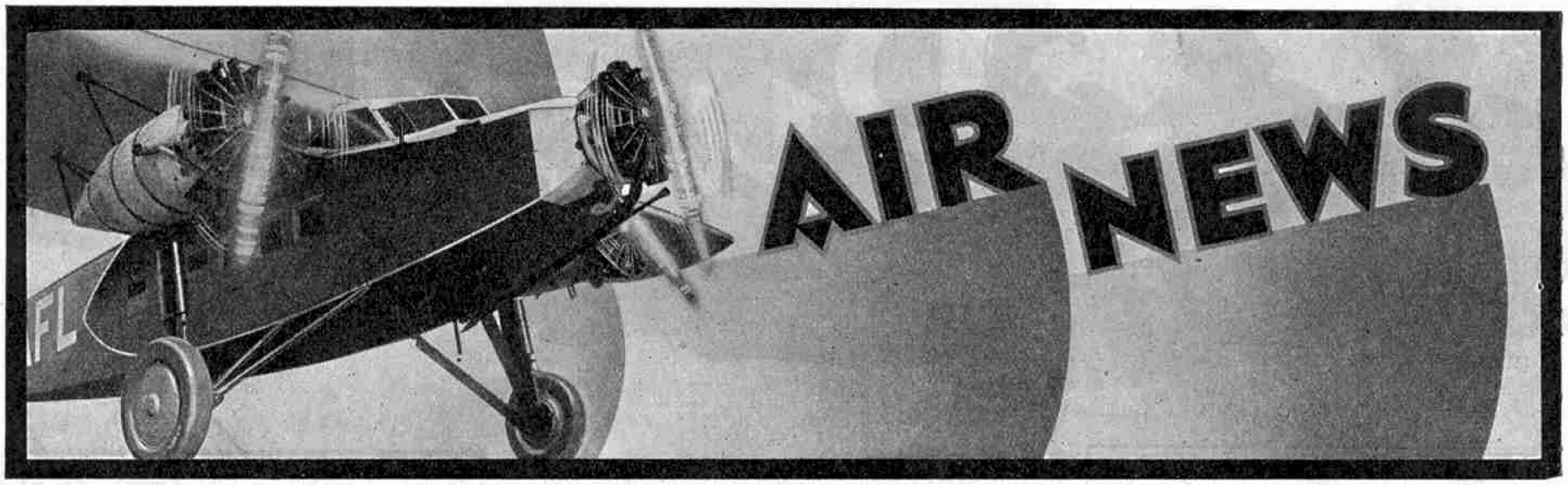
Puzzle No. 21

Replace each dot in the following collection of letters and dots by a vowel so as to form a sentence that reads the same both backward and forward:

R.DR..TP.T.PT..RD.R.

Puzzle No. 22

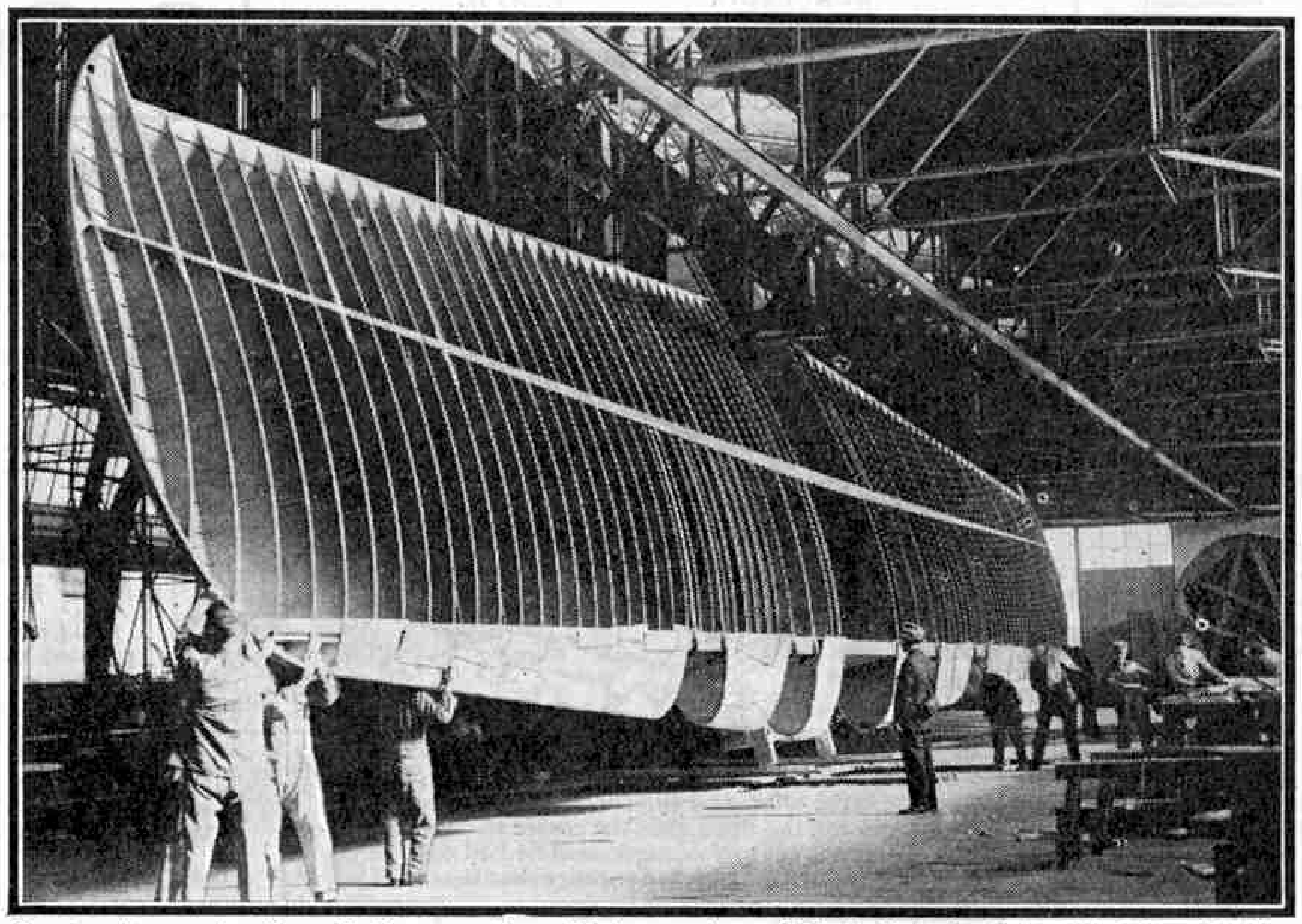
My first is in marrow, but not in bone.
My second's in plaster and also in stone.
My third is in bullock, but not in steer.
My fourth is in buck, but not in deer.
My fifth is in car and also in cab.
My sixth is in snatch and also in bands.
My whole brings joy to folk in all lands.



Winter Internal Air Services

Many of the internal air services that were in operation in this country during the summer have been suspended until next spring, but the number continuing to run during the winter is probably greater than in any previous year. Hillman's Airways are running a weekday service to Glasgow, with calls at Speke and Newtownards. This schedule may be altered when the company shortly remove to new headquarters being prepared at Gatwick Airport. Crilly Airways are operating services from Bristol and Norwich to Croydon, where the times of arrival enable passengers for Paris to catch Imperial Airways' service to that city.

Railway Air Services are continuing their regular daily services between London and Glasgow, with calls at Birmingham, Liverpool and Belfast, and a northern service is operated twice daily on weekdays between Liverpool, Blackpool and the Isle of Man. The company are forging ahead, and report that at the conclusion of their summer service their machines had flown 500,000 miles on regular trips, and had carried 300 per cent. more passengers than in 1934, when they were in operation from May to December. An increasing quantity of freight is being carried in addition to passengers.



Constructing a wing for a Fokker aeroplane. Photo. courtesy of N. V. Nederlandsche Vliegtuigenfabriek.

The winter air lines of United Airways include the first night-flying passenger service in this country. This is from Liverpool to Belfast, and on three nights of the week to Glasgow. Blackpool and West Coast Air Services are operating one daily service each way between Liverpool, Douglas and Belfast, and a service between Douglas and Blackpool by way of Liverpool.

Sweden-Poland Air Service

The early introduction of an air service between Sweden and Poland is indicated by experimental flights that have been carried out jointly by the Polish air line company L.O.T., and the Swedish Company A.B. Aerotransport. The flights have been made between Warsaw and Malmo by way of Danzig and Gdynia, a total distance of about 450 miles.

Miles "Nighthawk"

The latest type of Miles aeroplane is the "Nighthawk," a two-seater cabin monoplane. It has been adapted from the Miles "Falcon" that won the King's Cup Air Race this year, and of which an illustration was given in last month's issue. The "Nighthawk" is intended as an instrument and night-flying training machine. It has been produced at an opportune moment, as the Air Ministry now require "B" licence pilots to possess an instrument-flying certificate.

The new aeroplane is very like the Miles "Falcon" in appearance. The trailing edge of the wings has hydraulically-operated flaps, and landing lights operated from the cockpit are faired into the leading edge. The cockpit is fitted with dual control, and the double instrument panel carries two sets of blind and night flying instruments. The two pilots, instructor and pupil, sit side by side. Either half of the cabin can be shut off from the other, and the windows of the half occupied by the pupil can be obscured for instrument-flying instruction without interfering with the instructor's view.

Normally the machine is equipped with a D.H. "Gipsy Major" engine, which gives it a maximum speed of 150 m.p.h. at 1,000 ft., and a cruising speed of 130 to 135 m.p.h. A D.H. "Gipsy Six" engine can be fitted instead if required

Coventry to have Three Aerodromes

Coventry will soon have three aerodromes. At present there is only one, at Whitley Abbey, two miles south of the city, and owned by Sir W. G. Armstrong Whitworth Aircraft Ltd. The second aerodrome is being constructed at Anstey, six miles from Coventry, and is 140 acres in extent. When completed it will be used to accommodate a school for the training of candidates for Short Service Commissions and N.C.O. pilotships in the R.A.F., and of pilots for the R.A.F. Reserve. The school will be run by Air Service Training Ltd., and it is expected that it will have about 16 Avro "Cadet" biplanes. The construction of the third aerodrome, at Badginton, near Whitley, is well in hand. It will cover an area of 250 acres, and will be Coventry's municipal aerodrome.

British Machines in Danish Air Force

British aircraft are well represented in the Danish Air Force, which includes D.H. machines of the "Gipsy Moth," "Tiger Moth" and "Dragon" types; Bristol "Bulldog" fighters; Hawker "Nimrods" and "Dankoks," and Avro "Tutors." Another type will be added to the list when 18 Gloster "Gauntlets" now being built in Denmark under licence are put into service. The Gloster "Gauntlet" is a single-seater fighter, fitted with a Bristol "Mercury" engine.

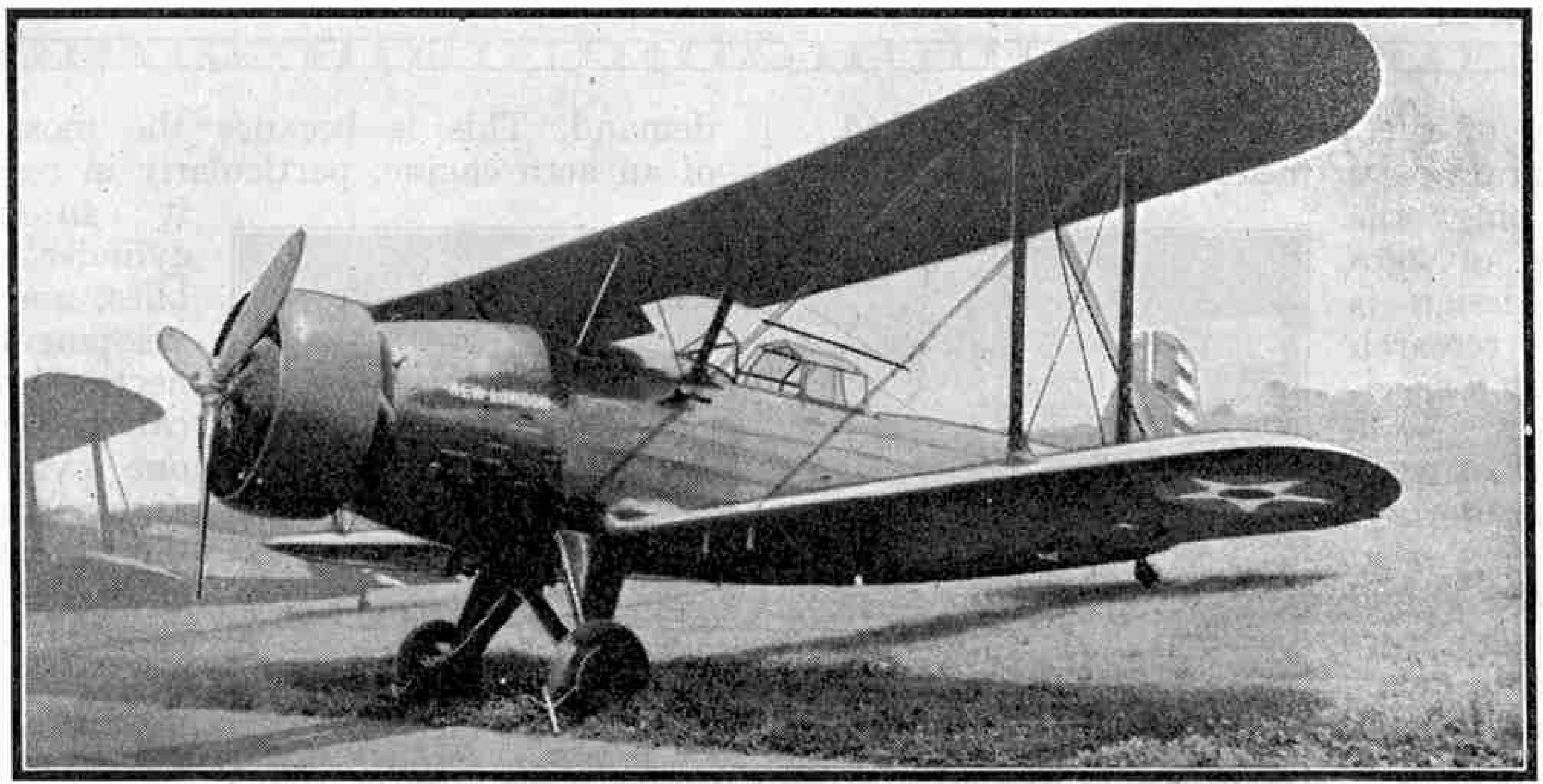
The Danish-built "Gauntlets" will be equipped with engines supplied by the Bristol Company.

Another Atlantic Flight

The 24th west-to-east flight across the Atlantic was accomplished recently by Lieut. Felix Waitkus, a Lithuanian airman now living in America. He took off from the Floyd-Bennett aerodrome at Long Island, U.S.A., in a Lockheed "Vega," to fly non-stop to Kovno, Lithuania. Shortage of petrol forced him down when still 800 miles from his destination, and he landed at Ballinrobe, Co. Mayo, Irish Free State. He was in the air 22½ hours.

The Control Tower at Croydon Airport

The lower illustration on this page shows the Croydon Airport control tower, from which aeroplanes approaching and leaving the airport, are guided by wireless when visibility is poor. At such times it is the centre of a controlled area or zone many miles in extent, which no aeroplane can enter without the permission of the control officer.



American two-seater military observation biplane. Photograph by J. Cunningham, Londonderry.

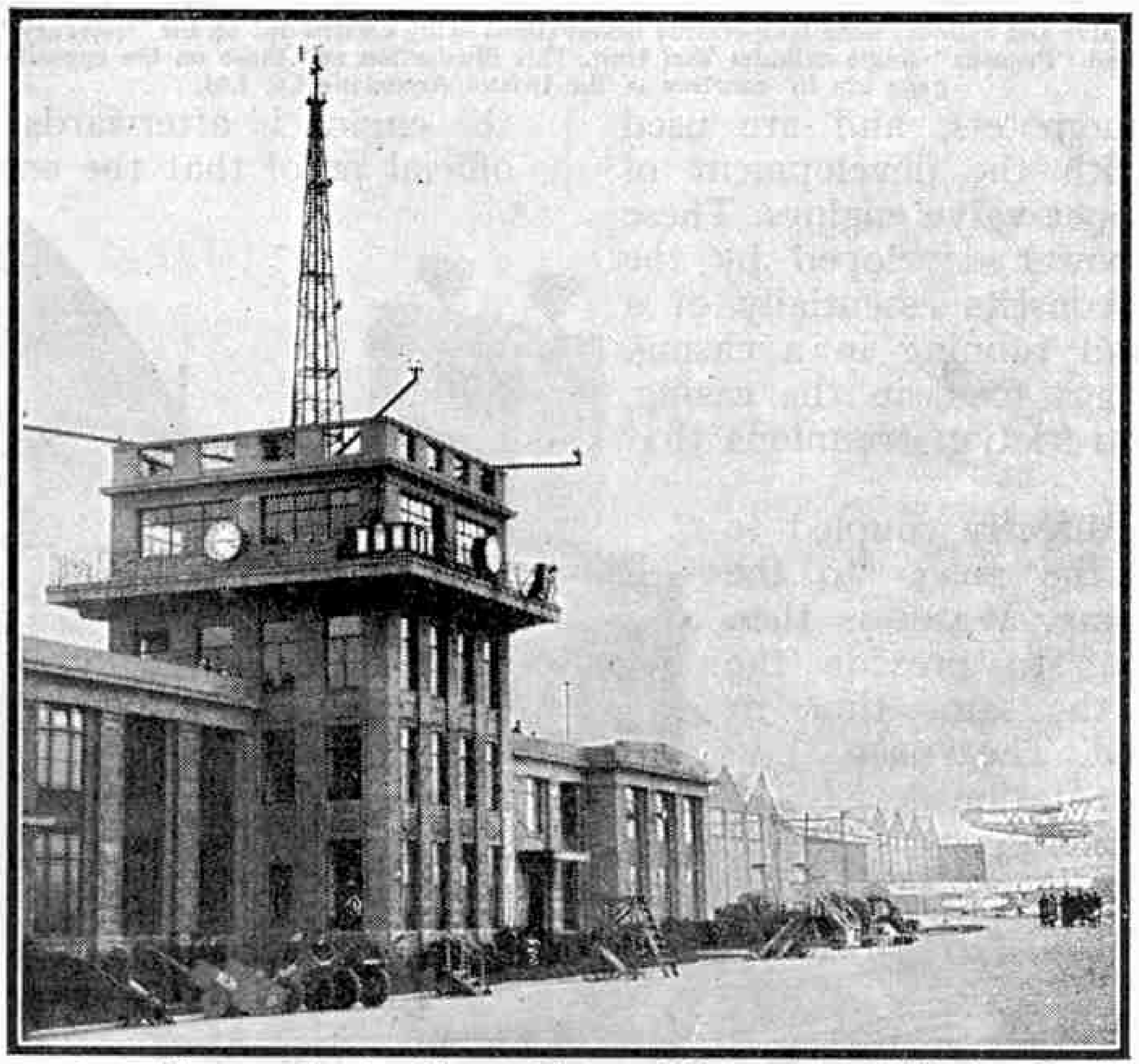
The pilots of aircraft fitted with wireless equipment are able to pick up any broadcast from Croydon announcing that the controlled zone scheme is in operation. If inward bound they inform the control officer of the time they expect to arrive, as only one machine at a time is allowed to enter the zone. He gives them permission to land at the time they state, or as near to it as possible in the circumstances.

Wireless equipment is not yet carried by all aeroplanes, and when visibility is poor the pilots of inward-bound machines without wireless land at Lympne, Gravesend, or one of the other aerodromes outside the controlled zone, and telephone to the control officer for permission to enter it.

When an aeroplane leaves Croydon a coded message recording its time of departure, registration mark, destination, and particulars of the crew and passengers, is sent by the Communications Office, a department in the control tower, to other ground stations, and a shortened version of the message is passed to the control officer. He has before him a map about 6 ft. square on which he pins small flags to indicate the positions of aeroplanes flying to and from the airport. Flags of different colours are used for the different air companies.

The latest development at Croydon is the installation of a G.E.C. system of floodlighting operated from the control tower. Each of the floodlights is of 1,000,000 c.p., and illuminates 4,500,000 sq. ft. of landing ground.

Efficient floodlighting of the airport is essential, as this winter Imperial Airways are operating two evening services from there, one at 7 p.m. to Paris and the other at 8.15 p.m. to Budapest. On the latter service a halt is made for the night at Cologne.



The Control Tower at Croydon Airport. Photograph by courtesy of "The Aeroplane."

Large Monoplane for Air France

A large three-engined low wing monoplane has been produced by the Marcel Bloch company for Air France. It has three Gnôme-Rhône "Mistral Major" engines, a retractable undercarriage and accommodation for 30 passengers, and has a cruising speed of 170 m.p.h.

Imperial Airways Developments

During last year Imperial Airways carried more passengers than all the foreign air companies put together. Important developments planned for the near future will help to maintain this lead. Arrangements have been completed for a regular air connection between Khartoum, on the main England–South Africa route, and Nigeria. Experimental flights between Penang and Hong Kong are being carried out as a preliminary to establishing a regular service between Hong Kong and the main England–Australia service.

Previous difficulties in regard to flying over French territory have been overcome, and preliminary flights are in progress on the Paris-Brindisi section of the Empire air route. When regular flying is established on this section, the present Paris–Brindisi train link will be eliminated and the Empire air services operated by aircraft all the way.

It is hoped to inaugurate next year a passenger and mail service between Brindisi and New York, in co-operation with Pan American Airways. A large flying boat is being built for this service.

New Short type Flying Boats

Some details are now available about the fleet of large all-metal flying boats under construction by Short Brothers (Rochester and Bedford Ltd.) for Imperial Airways. Each vessel will be of the high-wing monoplane type with wing-tip floats, and will have a span of 114 ft., an overall length of 88 ft. 6 in., and an all-up weight of about 17½ tons. These figures are slightly greater than those of the company's Short "Scipio" flying boats used on the Mediterranean section of the Empire air route.

Each vessel will be fitted with four engines, which are expected to give it a speed of 200 m.p.h., and will carry sufficient fuel for a non-stop flight of about 1,500 miles. There will be two decks, the crew being in the upper one and the passengers below. The upper floor will have the crew's quarters, the control cabin, the wireless telegraphy cabin equipped with short-wave and direction-finding apparatus, and the mail room. The passengers' quarters have been planned on a luxurious scale, and will attain a higher standard of comfort than is to be found on any present-day air liner. Sleeping accommodation will be available for passengers travelling long distances, so that they can remain on board when the vessel moors on the water for the night. As the wing is above the hull passengers will have a wide and unobstructed view.

Progress of Civil Aviation

The latest issue of the Air Ministry annual *"Report on the Progress of Civil Aviation"* was published recently, and covers developments during 1934 in 38 countries of the world. Although another 11 months of air transport have passed since the latest date dealt with by the report, it gives an interesting insight into the growing adoption of aircraft for the transport of both passengers and freight.

The report shows that at the end of last year the air routes of the world totalled about 223,100 miles, an increase of 32,800 miles over the total for 1933. The United States topped the list with 50,801 miles of air lines, and the British Empire was next with about 41,000. Then followed Germany with 23,442 miles, and France 21,295 miles.

The safety of modern air transport is indicated by the fact that in 1934 there were only two fatal accidents in a total of 51,600 flights on which 135,100 passengers were carried.

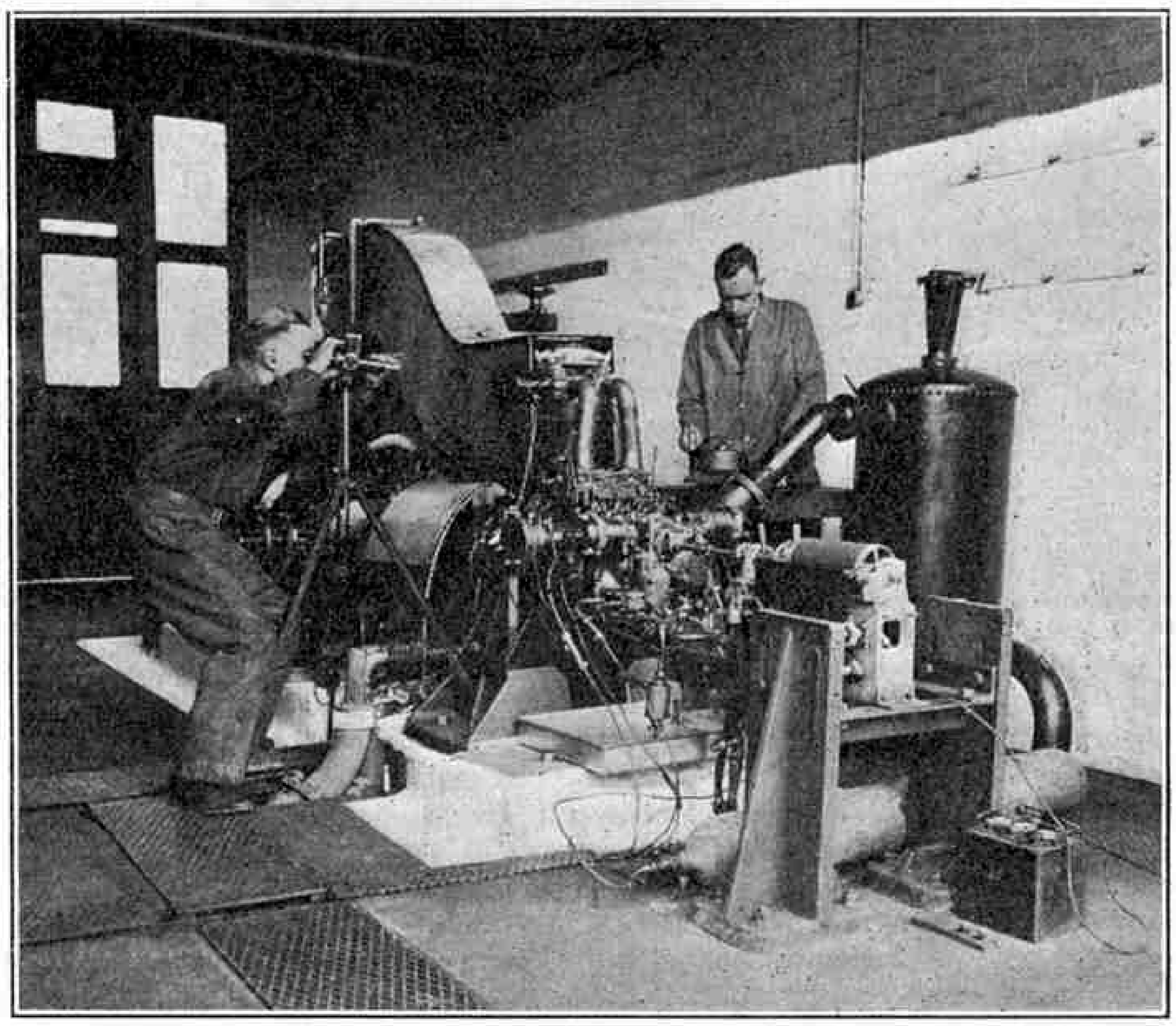
The developments in each country are dealt with separately in the report.

Testing "Bristol" Aero Engines

Research that Leads to Improved Designs

At the factory of the Bristol Aeroplane Co. Ltd., there is a separate department where the important work of developing the main components of aero engines of new design is carried out by a research engineer assisted by a specially qualified staff. Some idea of the amount of work carried out in this department may be gained from the fact that over 11,000 hours' running were performed on the single cylinder test units last year.

The testing plant is divided into seven units, which are housed in separate buildings and cubicles specially designed to give the most convenient layout for each testing process. Each cubicle is equipped with the necessary indicating and measuring instruments. Six of the units are equipped with Heenan and Froude hydraulic dynamometers, and are used for research in connection with the development of "Bristol" sleeve valve and poppet valve engines. These dynamometers measure the power developed by the engine under test, and each consists essentially of a rotor mounted on a shaft and running in a casing. The shaft is carried by bearings fixed in the casing, which is free to swivel on anti-friction trunnions that support it.

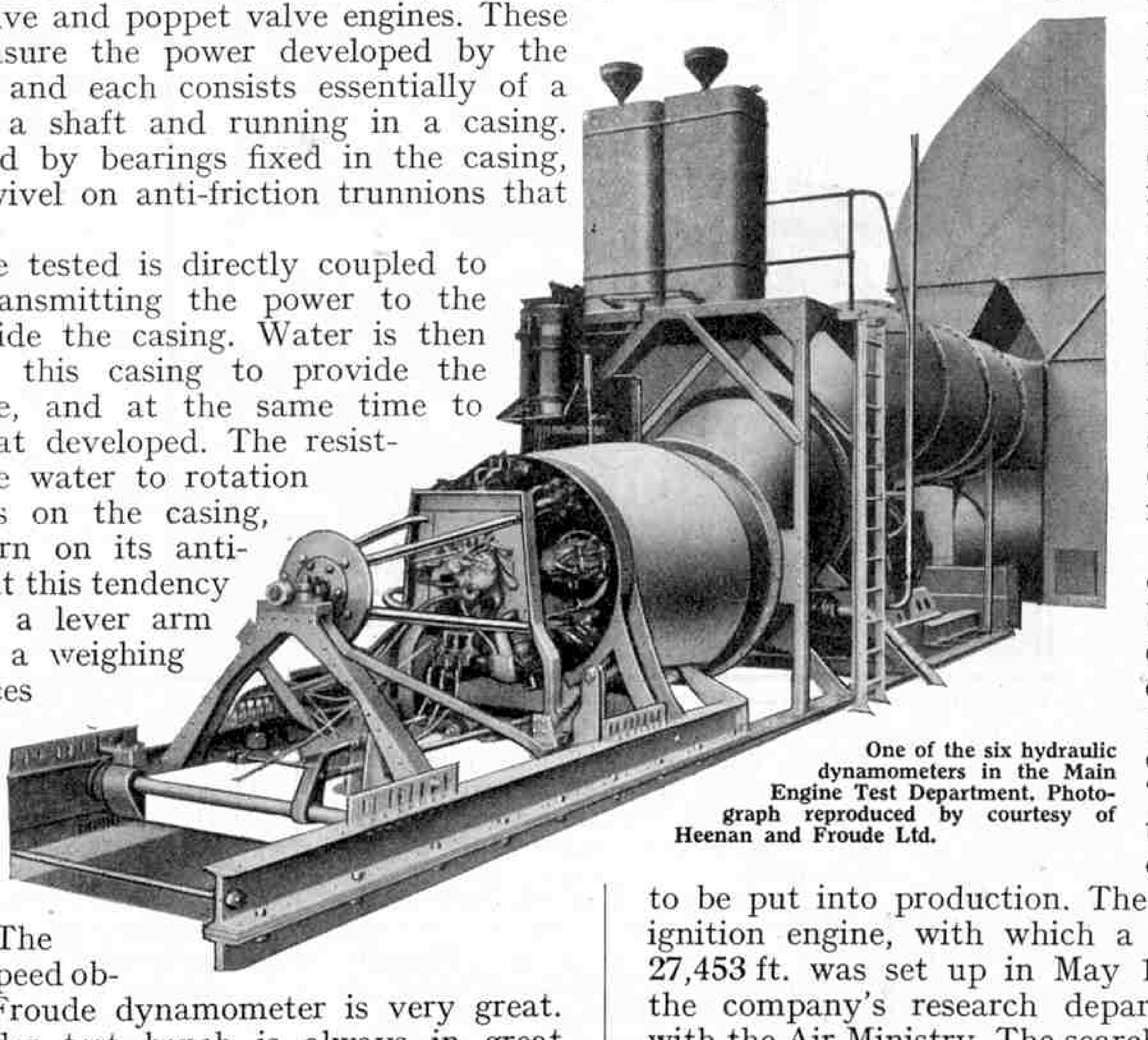


Valve and cylinder head temperature observations being carried out on the "Mercury" and "Pegasus" single cylinder Test Unit. This illustration and those on the opposite page are by courtesy of the Bristol Aeroplane Co. Ltd.

The engine to be tested is directly coupled to the main shaft transmitting the power to the rotor revolving inside the casing. Water is then circulated through this casing to provide the hydraulic resistance, and at the same time to carry away the heat developed. The resistance offered by the water to rotation of the rotor reacts on the casing, which tends to turn on its anti-friction supports; but this tendency is counteracted by a lever arm that terminates in a weighing device. Thus the forces resisting rotation of the engine shafts are caused to react on the weighing apparatus, ensuring scientific accuracy. The range of power and speed obtainable with the Froude dynamometer is very great.

The single cylinder test bench is always in great demand. This is because the most important parts of an aero engine, particularly in respect to the power it can develop, are the cylinder and piston assemblies, and much of the development work in connection with a new engine can be achieved with only one cylinder unit of the design concerned. Valuable information and the results of hundreds of hours' running can be obtained with it in a fraction of the time and at much less cost than would be necessary if a complete engine were built for the purpose.

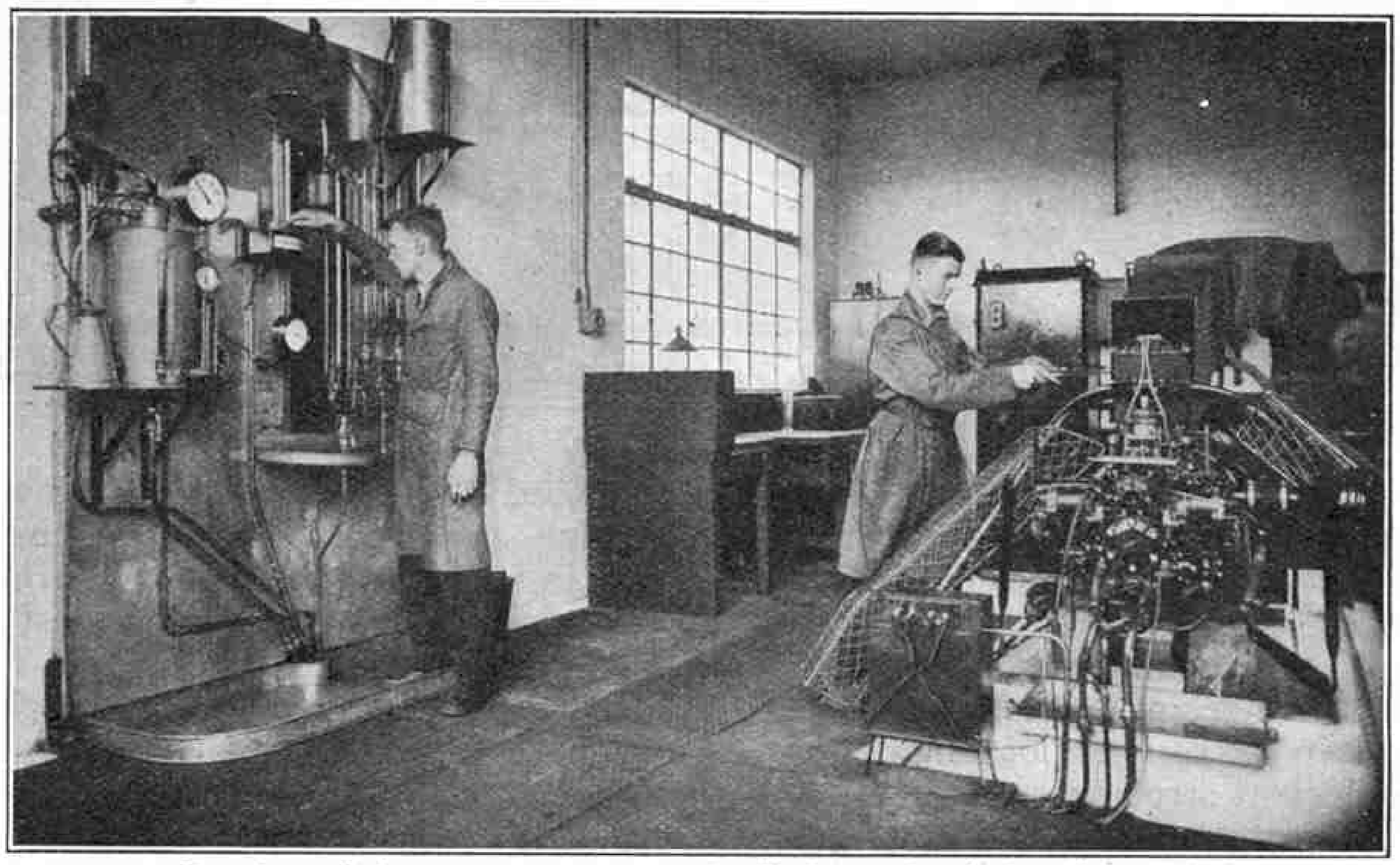
The preliminary testing of a new type of aero engine is followed by further research to ensure that it will really have the power, speed and durability that it is designed to possess, and the type test to which the engine is afterwards subjected affords the maker's official proof that the engine fulfils these requirements.



One of the six hydraulic dynamometers in the Main Engine Test Department. Photograph reproduced by courtesy of Heenan and Froude Ltd.

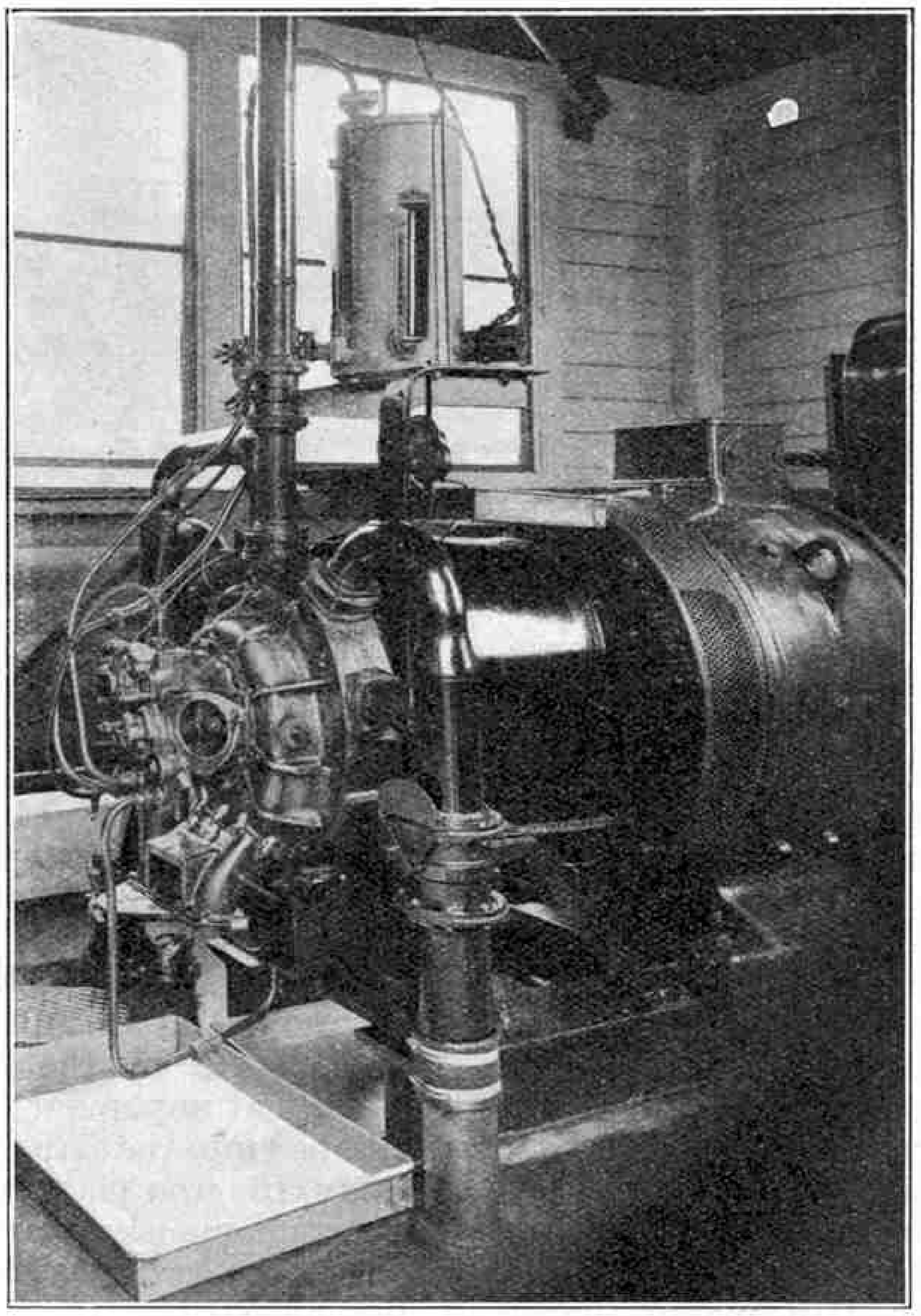
Development work does not cease even when the engine has passed this severe test. A thorough investigation is made into the possibilities of obtaining more power and greater reliability from it by alterations in the valves or their dimension, in the materials used, or in any of the other factors contributing to its existing efficiency.

Many forms of air-cooled aero engines have been evolved, tested and developed by the Bristol company during the past 10 years. Recent introductions have been the "Aquila" and "Perseus" types of sleeve valve engine, which are shortly to be put into production. The "Phœnix" compression ignition engine, with which a world height record of 27,453 ft. was set up in May 1934, was developed by the company's research department in collaboration with the Air Ministry. The search for means of increasing the power output of this engine included a study of the effects of supercharging, a method of improving engine performance that has become of great importance.



Observing cylinder temperatures on a "Bristol" sleeve valve single cylinder Unit.

As supercharging requires a great deal of research and development work, elaborate test equipment has been provided specially for it in the Bristol factory. This plant includes two electric dynamometers, in separate test rooms. The smaller one was installed in 1928 and has a 100 h.p. motor with a speed range of 1,700 to 2,700 r.p.m. The maximum speed attained by aero engines has mounted so rapidly in recent years, however, that a 4 : 3 increasing speed gear-box has been added to this apparatus so that it can cope with the more severe test conditions of to-day. The larger dynamometer was introduced in 1933 with a view to future needs, and its motor can develop 250 h.p. at speeds up to 5,000 r.p.m. Each dynamometer has a clutch that permits the drive to be engaged as suddenly as desired for the purpose of imposing severe loads on the supercharger.



This photograph shows one of the "rigs" provided for supercharging aero engine Units.

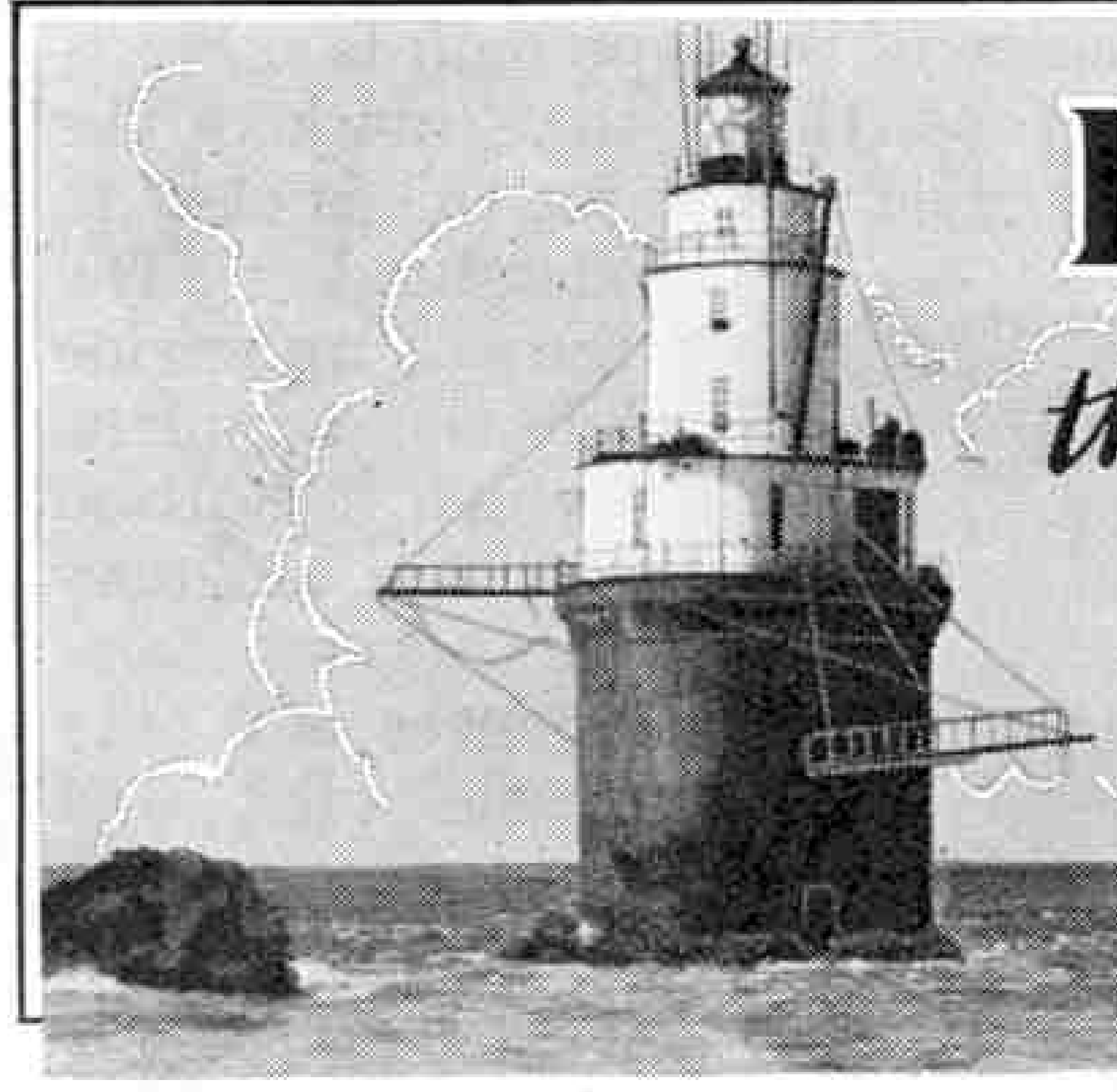
Another important branch of the work of the engine research department is the testing of auxiliary parts of aero engines, and this is carried out in a separate room. The apparatus used is arranged in four groups known as "rigs," two of which are reserved for the testing of engine rear covers and their parts. These two are driven by a 14 b.h.p. and a 4 b.h.p. electric motor respectively, and one is suitable for "Mercury," "Pegasus" and "Perseus" engine equipment, and the other for "Aquila" engine equipment. The third rig is driven by a 15 h.p. electric motor. It has been specially produced for testing the durability of aero engine master rods under a variety of loaded conditions, and results can be obtained after 60 hours' running that would take four times as long if a complete engine had to be used. The fourth rig is driven by a motor of 25 h.p., and is reserved for testing master rod bushes. In this plant the bush to be tested can be loaded up to 50,000 lb. by means of a hydraulic ram.

When a new engine design is finally approved and is put into production, every engine of the type built is subjected to tests as searching as those that marked the development of the design. The reason for this is easy to understand. The failure of an engine while the aeroplane to which it is fitted is in the air may have serious consequences, not only for the pilot and passengers of such a machine, but also for people on the ground. So great is the importance attached to the tests that they are carried out in strict accordance with regulations laid down by the Air Ministry, and in addition to power output the consumption of fuel and lubricating oil must be measured.

The testing equipment in the Bristol Company's Main Engine Test Department is very complete and consists of six Heenan and Froude hydraulic dynamometers, one of which is illustrated on the opposite page. A conspicuous feature of this apparatus is the large wind tunnel through which is directed a blast of cooling air upon the engine under test. The engine is mounted upon a mobile cradle, thus facilitating the handling of the engine. After the engine is mounted on the dynamometer, the shaft is fitted with an adaptor for connecting it to the flexible shaft of the dynamometer. When running under these conditions the entire power of the engine is absorbed and accurately measured.

During the test the engine is placed in the mouth of the wind tunnel, which is built of heavy steel plate, the necessary airstream being provided by means of a specially designed high-speed electric motor. Owing to the need for keeping the dynamometer out of the airstream, the tunnel is curiously shaped, passing over the measuring instrument and curving by easy bends to the opening facing the engine.

The latest addition to the plant in the department is a tilting test stand of special design, incorporating a mounting that allows the engine to be tilted either up or down while running, in imitation of climbing or diving conditions. The mounting is operated from a test cabin. An illustration of this interesting apparatus was given on page 574 of the *"M.M."* of October, 1935.

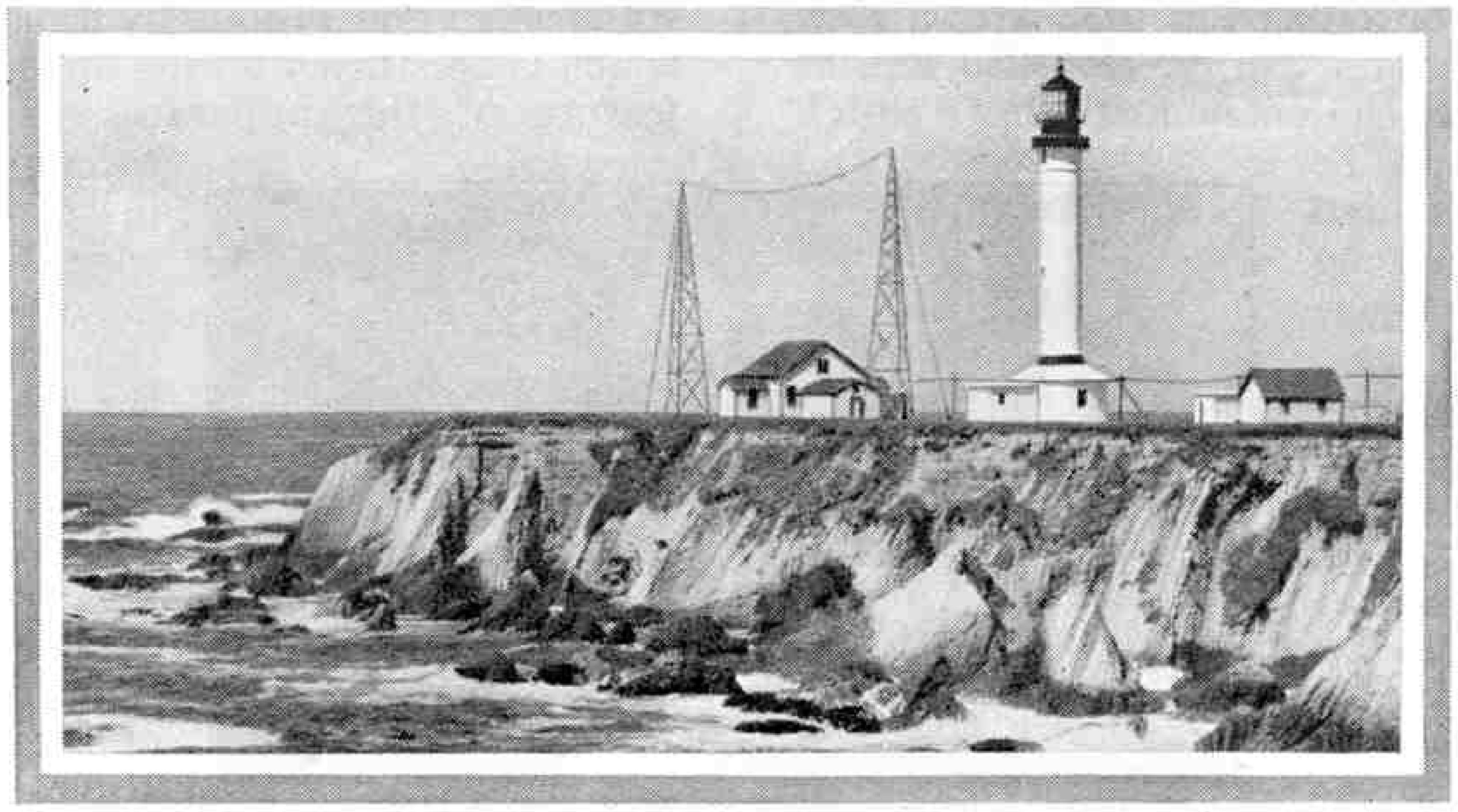


LIGHTHOUSES ALONG the CALIFORNIAN COAST

Strange Incidents of Winter Storms

By Harold J. Shepstone F.R.G.S.

It has been said of American lighthouses that no two are alike, and there is some truth in this statement. Some of them are built of stone, massive, tower-like erections like those found around our coast; others are of iron or steel, and still others of wood. Many of them are quite attractive edifices, reminding one more of a palatial residence standing on a lonely rock in the sea than of a lighthouse. Nevertheless, they are efficient structures, equipped not only with a powerful light, but with automatic fog signals and the very latest devices for aiding the mariner. Indeed, "Uncle Sam" is now fitting these beacons with radio, which means that in fog or storm a mariner can send out a signal and a few seconds later receive word as to his whereabouts and how best to proceed.



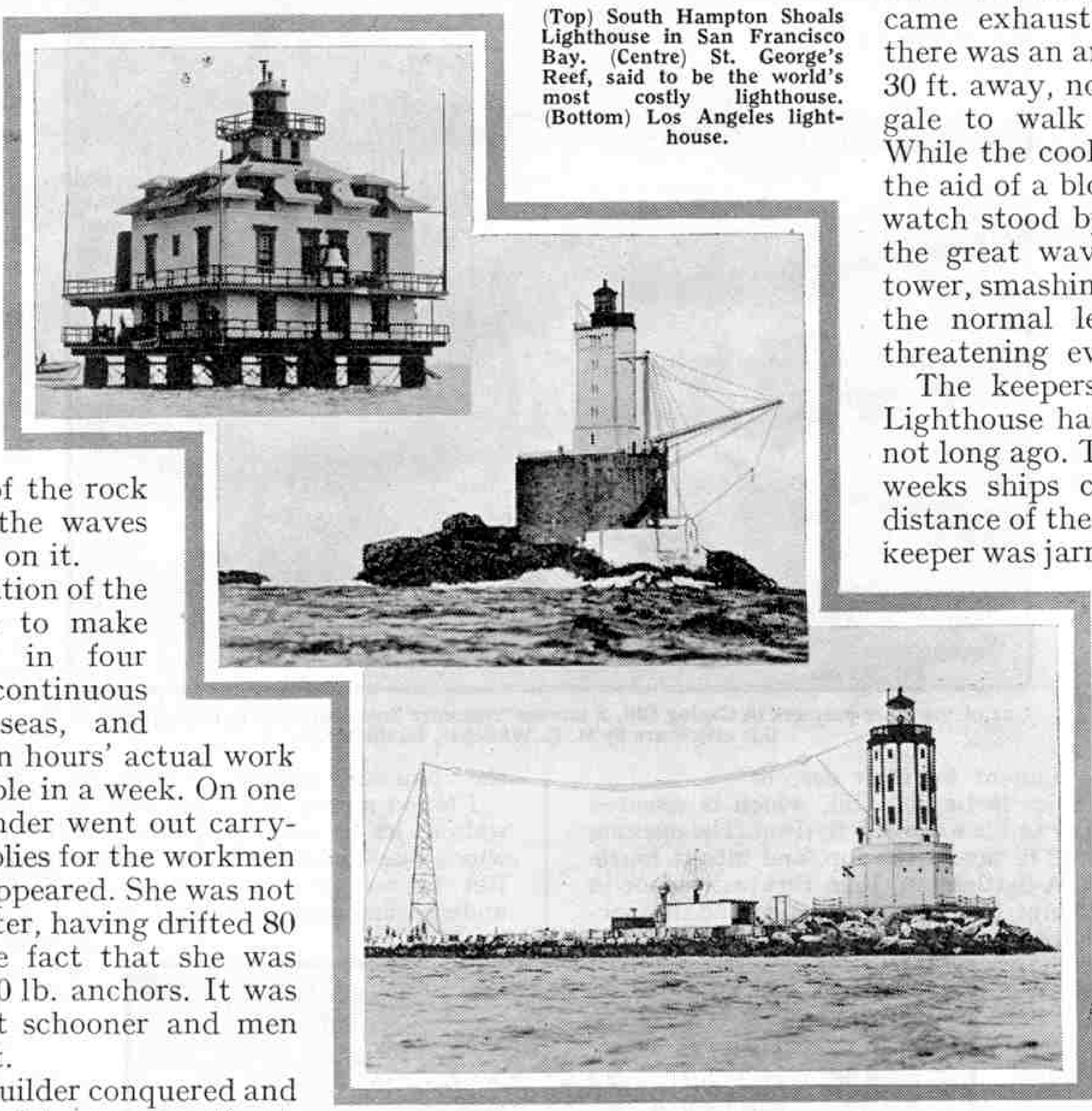
Point Arena, graveyard of Pacific ships, offers every modern aid to shipping in spite of its isolation. Mile Rocks Lighthouse is shown in the heading.

Probably there is no other stretch of coast line where the lighthouses present such an array of different types as are to be found along the Pacific coast of America. Of the 39 beacons along California's 1,000-mile coast no two are exactly alike. Many of them have been erected within the last 10 or 12 years, and they may be said to represent the latest practice in lighthouse building. Some of them are quite novel structures, such as the South Hampton Shoals beacon erected only a few years ago in San Francisco Bay. This is one of the few lighthouses in the world to be built on stilts, and its main work is to warn shipping away from the shallow waters of the Bay. This great square-shaped building, with its many windows, spacious verandahs, and quaint tower, has more the appearance of a seaside hotel than of a lighthouse. The building is carried on iron piles driven deep into the ocean bed, and driving the piles in the open ocean proved no light task on account of the swift currents and choppy seas experienced at this point.

Not far away is the Mile Rocks Lighthouse, which helps to guide ships through the Golden Gate. In this case, however, the beacon rises from a lonely rock. The base is a great circular structure fashioned of massive steel plates, strongly bolted to one another, the interior being filled in with concrete. On this firm foundation, well above the ordinary wash of the waves, rises the lighthouse proper in three successive tiers, the topmost one being crowned with a lantern. The erection of this light on an exposed wave-washed rock proved a difficult undertaking, and occupied three seasons of hard and laborious toil in very trying seas and weather.

One of the sea-builders' greatest triumphs on the coast here was the building of the Tillamook Lighthouse. Tillamook is a small, abrupt rock formation, one mile from the mainland. Its sides are so precipitous and so inhospitable that even in calm weather landing is extremely dangerous, and during the first attempt to put a working party on the rock the foreman lost his life. The first thing the men had to do after they had effected a landing was to drive away a particularly vicious herd of sea-lions! The next step was to erect a shelter made of iron and wood and bolted to the rock. One night a tornado drove the waves completely over the rock, crushing in the shelter in which the men slept, and washing away most of their provisions, and nearly all their tools, clothing and equipment. For days at a time, in the coldest weather of a northern winter, the men were compelled to lie clinging to the slippery rock, drenched with icy water, buffeted by swiftly-succeeding storms of snow and sleet, and lashed by the bitter sea winds. Some idea of the strength of the waves at this spot may be gained from the fact that a few winters ago a boulder weighing 148 lb. was lifted bodily and sent crashing down through the roof of the tower. The lighthouse stands 183 ft. above the breakers, and to reach it one rides upward in a skip—a sort of open-air elevator—suspended from a steel cable. A recent incident reveals the occasional bit of humour with which the many lonely hours spent by the keepers of the light is broken. A somewhat unpopular inspector arrived at Tillamook and climbed into the skip for a ride upward. As his boat pulled away, the iron platform on which he stood suddenly and unceremoniously started a downward movement. It struck the water without halting and immersed the dignified official beneath the waves. He came up spluttering with rage. A second time he was dropped. Again he spluttered, and once more he descended into the sea. This time he held his tongue. Whether any casual relation existed between his expletives and repeated duckings I cannot say, yet it is true that his silence after the third immersion was followed by swift and safe ascent. The sequel I cannot relate, for no record exists of his conversation with the operator of the skip during the ensuing hour.

What is declared to be the most costly of lighthouses is St. George's Reef, which stands on an isolated rock some 14 miles off the coast of California. It took seven years to build and required an expenditure of £150,000. The rock is so exposed and swept by the seas that the workmen could not safely live on it as they did at Tillamook, and it was necessary to moor a schooner near the rocks to provide quarters for them. They were transported back and forth in a cage suspended from a traveller on a cable one end of which was made fast to the rock and the other to the mast of the schooner. A quick means of getting off the rock was necessary as heavy waves, resulting from off-shore winds, would begin breaking on the rock without any local warning, and the sea would rise so suddenly that in three or four hours from a dead calm the crest of the rock would be swept by the waves and no one could live on it.



(Top) South Hampton Shoals Lighthouse in San Francisco Bay. (Centre) St. George's Reef, said to be the world's most costly lighthouse. (Bottom) Los Angeles lighthouse.

At the first examination of the rock it was possible to make only four landings in four weeks. It was a continuous battle with heavy seas, and often only six or seven hours' actual work on the rock was possible in a week. On one occasion when the tender went out carrying the necessary supplies for the workmen the schooner had disappeared. She was not found till four days later, having drifted 80 miles, in spite of the fact that she was moored by two 12,000 lb. anchors. It was thought at first that schooner and men had been entirely lost.

In the end the sea-builder conquered and crowned the rock with a magnificent lighthouse. It stands on a specially prepared foundation, or pier, rising to a height of 70 ft. above the water. Above this is the lighthouse proper, a square granite tower, with a projecting stair cylinder. The lantern with its light is 146 ft. above the sea.

Engineers declare that no storm, however severe, could possibly dislodge this massive-built beacon of interlocking granite blocks on St. George's Reef. Nevertheless, American lighthouses have been seriously damaged by exceptionally heavy gales. One recent storm threatened the destruction of the Los Angeles Lighthouse, a remarkable structure in many ways, built at the end of a rocky finger that extends two miles out into the sea. For five days the wind howled and waves beat at its sides; and when, after the sun reappeared, the keepers dared venture forth into the open, they dropped a weight from the top by a line, and found that the tower leaned in towards the land! To this day it leans away from the sea, as though afraid of more storms to come.

The smallest shipwreck ever recorded by a lighthouse service occurred at the Los Angeles Lighthouse. Three men had put out in a skiff. Green seas broke over the rocks, yet they ventured forth after fish, and did not seem to realise the danger they faced as the tiny craft bobbed about in the wind-lashed waves. Suddenly, without the slightest warning, a swell rolling in from the depths lifted the skiff, dropped it on the rocks beside the light tower, smashed it to smithereens, but left the valiant three unhurt. So hard did the wind blow and the waves lick at the breakwater that the men could not reach shore for two whole days.

Last midwinter the keepers of this particular beacon were marooned for an entire week, although their tower is connected with land by a solid line of heavy rocks. After the second day their fuel became exhausted, and even though there was an ample supply in a shack 30 ft. away, no man dared brave the gale to walk that short distance. While the cook prepared meals with the aid of a blow torch, others of the watch stood by helplessly, watching the great waves breaking over the tower, smashing windows 30 ft. above the normal level of the sea, and threatening even the light itself.

The keepers of the Los Angeles Lighthouse had a unique experience not long ago. Three times in as many weeks ships crashed within calling distance of the beacon. One night the keeper was jarred from his chair when a rending crash of shearing metal split the night with its message of disaster. He leaped to the window, and there, almost at his feet, was a battleship! Some mix-up of signals or misunderstanding of the course had driven her on the rocks in a storm; yet within a few minutes, due to the good fortune of a glancing blow instead of a head-on collision, she backed away and proceeded to port under her own power. A few days later a merchant steamer, essaying a short-cut into the harbour, smashed into the breakwater, tossing aside rocks weighing 10 tons as though they were so much straw. Again, due to some unexplained good fortune, she escaped relatively undamaged. Ten days or so later five fishing boats seeking shelter in the lee of the rocks from a sudden storm were tossed on the breakwater. All the men were saved.

The light commonly in use in the lighthouses off the Pacific coast consists of two lenses of concentric rings including 60 curved glass prisms. Such a light which costs £11,200, has an official range of 14 miles, but the glow can be seen in the sky on a fair night as far away as 25 miles. In normal circumstances the light alone provides adequate guidance for all ships. But the dread of the mariner is fog. Then fog sirens are resorted to, the captain of the vessel ascertaining his whereabouts by noting the direction and number of the blasts. As a further aid the lighthouses are now equipped with radio beacons.

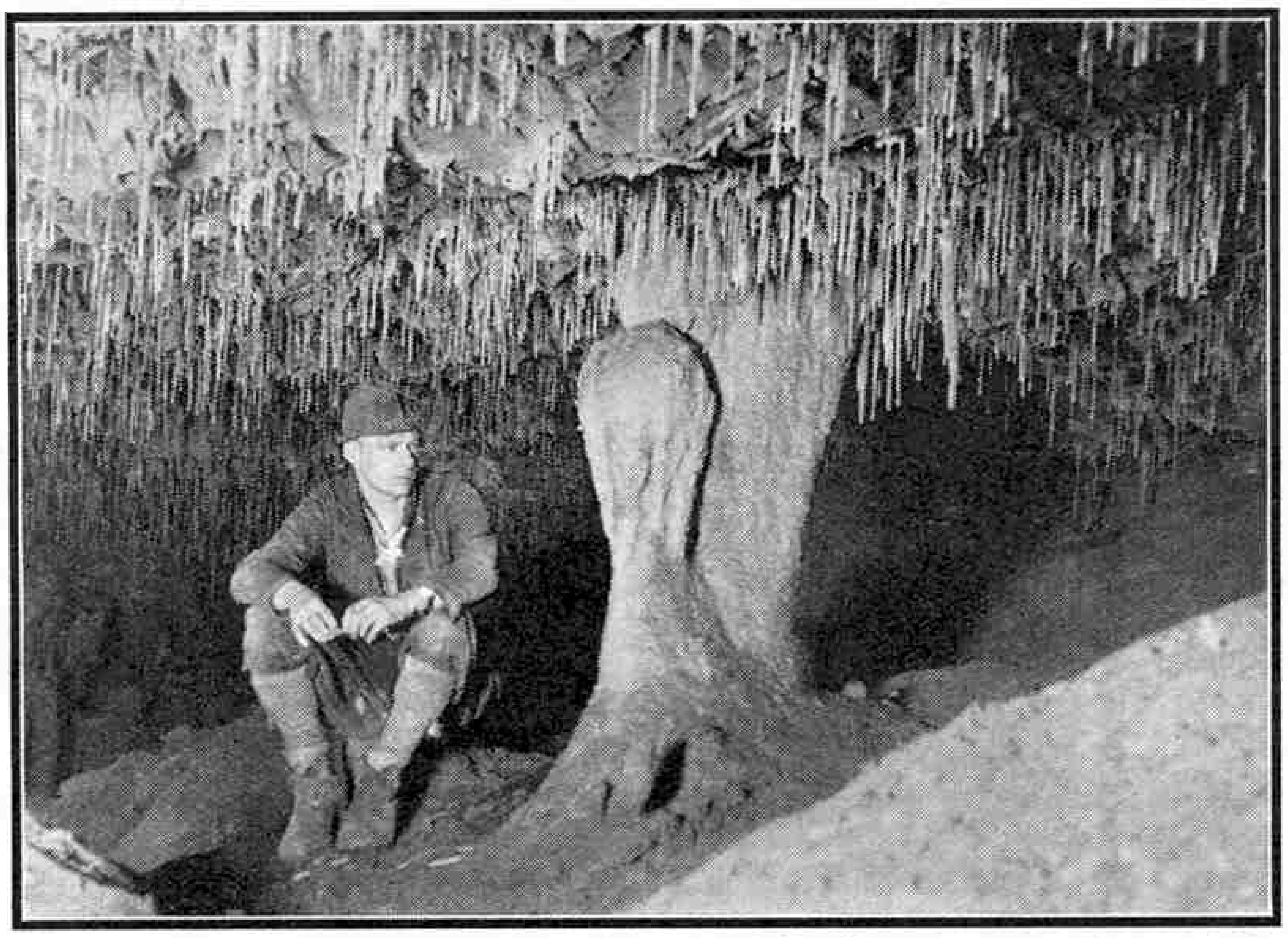
Yorkshire's Underworld

The Fascination of Pot-holes and Caverns

By Sydney Moorhouse

By reason of its unique subterranean structure, Yorkshire is one of the most interesting counties in England from a geological point of view.

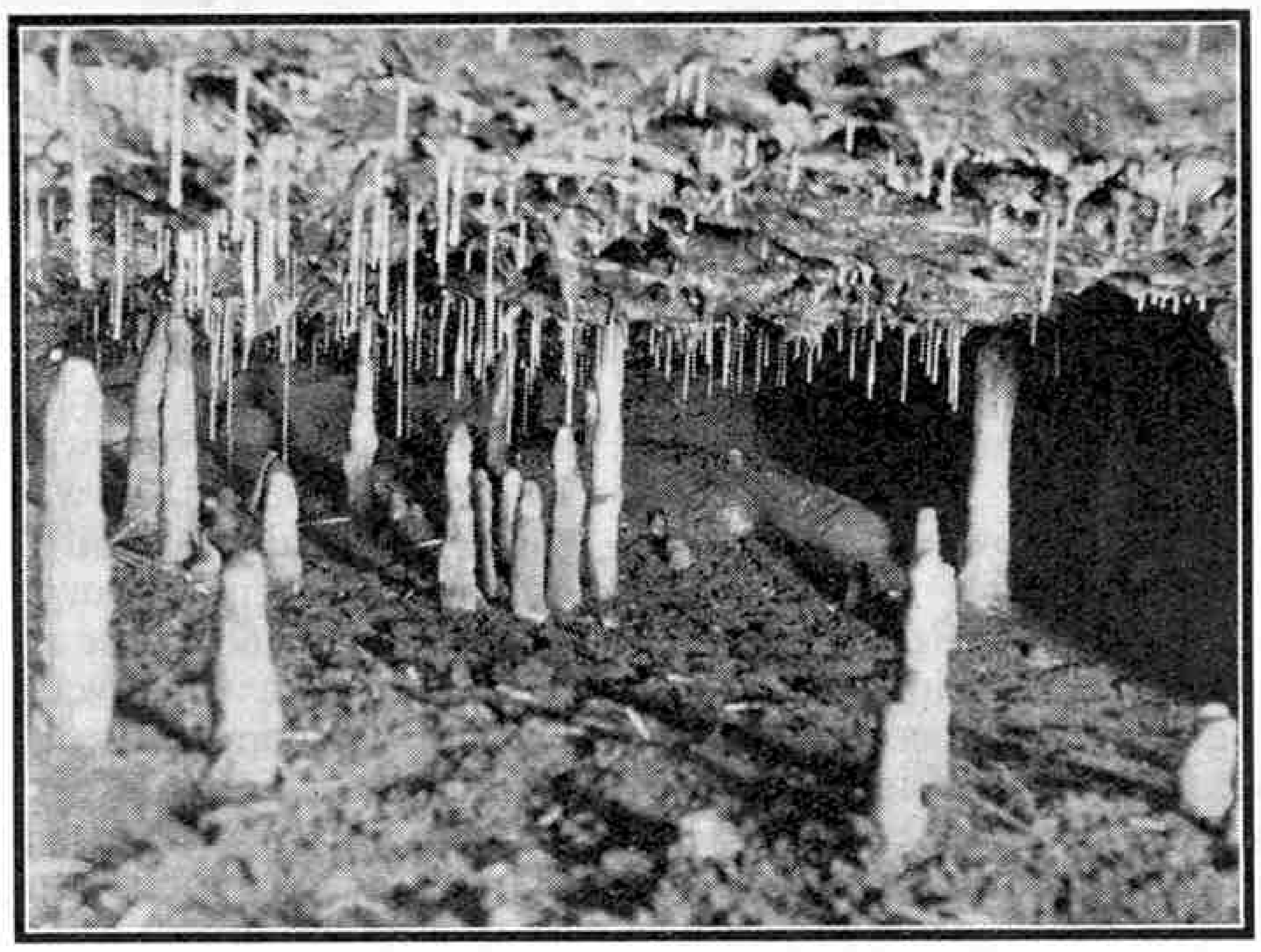
Amongst the limestone hills of Craven will be found immense pot-holes and caverns which have been hollowed out by the action of water on cracks and fissures in the stone. Deep down beneath the surface of the earth are rushing streams, great waterfalls, subterranean lakes and mighty amphitheatres; and the pastime of speleology, or "pot-holing" as it is more commonly called, which consists of the exploration of these underground ways, is a most fascinating one.



One of the main passages in Gaping Gill, a famous Yorkshire limestone cavern. Photographs to this article are by H. E. Whitaker, Denholme.

Theoretically speaking, a pot-hole is a vertical cave, and is usually connected with systems of caverns and underground watercourses. There is, however, in actual fact very little difference between a pot-hole and a cave, for Goyden Pot, in Nidderdale, is actually a cave, while Lost John's Cave, on Lech Fell, above Dentdale, is really a series of "pots" which require a considerable amount of equipment for their descent.

The largest of the pot-holes is Gaping Gill, which is situated on the slopes of Ingleborough and is some 365 ft. deep. The opening of the main shaft is about 40 ft. across the top, and into it hurtle the waters of the Fell Beck. A Settle man, John Birkbeck, made in 1872 the first recorded attempt to descend the pit, and he succeeded in reaching a ledge 206 ft. below the surface. In 1895 a Frenchman, E. A. Martel, succeeded in getting to the bottom by means of rope ladders. To-day, however, much simpler methods are employed. In order to provide a drier descent the stream is diverted so as to prevent its main force from falling over the lip of the hole, and a winch driven by a petrol engine lowers and lifts a bo'sun's chair in which the pot-holer is carried into the depths.



Striking icicle-shaped formations in Gaping Gill.

My first visit to the underworld of Gaping Gill was in the company of the members of one of the leading Yorkshire cave-exploring clubs. Heavy rain had fallen throughout the previous night, so that when we arrived at the top of the pot-hole the stream was pounding down the main shaft and forming an almost impassable barrier. However, floods soon subside in limestone country, and we had not long to wait before we could make the trip. Soon the first man was standing on the wooden gantry which stretched across the mouth of the hole, and was ready to make the descent; and when he had been safely lowered down, my turn came. As the chair passes through the spray of a waterfall, one has to be well attired in waterproofs, and even then is not spared a wetting!

The journey down the main shaft was a wonderful experience. All I was conscious of at first was a feeling of sliding, yet so rhythmic was the entire movement that I had none of the "sinking feeling" I had anticipated. Light gradually receded and a gloom enclosed me. To my ears came the crashing of falling waters. The rocks on both sides of the cave were streaming with water and luxuriant ferns were growing on the walls.

Thirty feet down a great fall of water issued out of the mountain side, and I looked down to see another huge volume pouring out below. For a moment I thought I was going right through it, but a guiding rope took the chair away from the main fall. On all sides were curtains of water, and I gazed down into rainbow-hued depths.

The walls of the shaft fell away, and I was conscious of nothing but darkness around and a deafening roar of falling water in my ears. Then my feet touched something solid, and I was lifted out of the chair and hurried to some place out of reach of the spray.

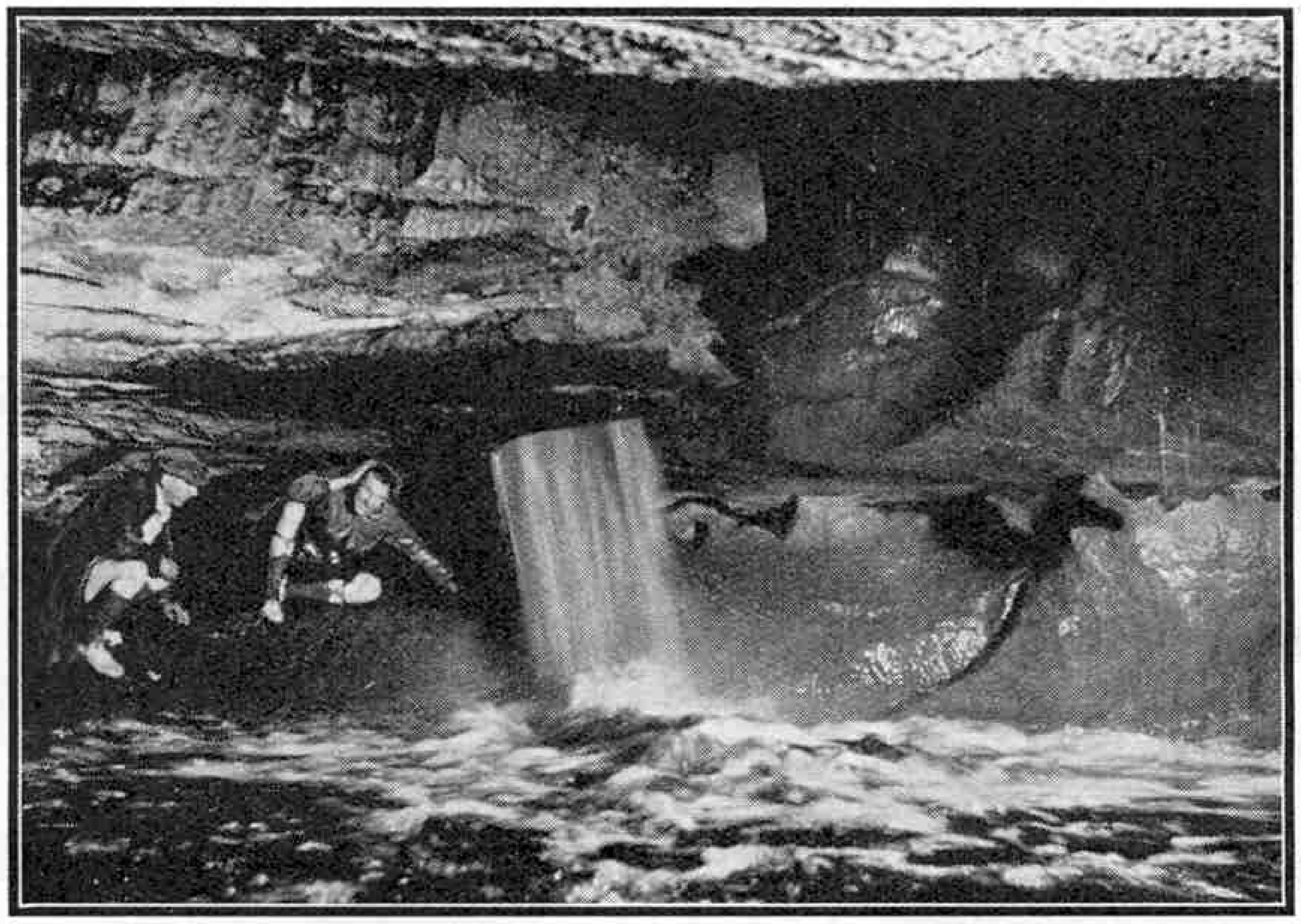
I found myself in a great hall, measuring 480 ft. in length, 82 ft. wide at its broadest part, and 110 ft. high, a tremendous cave in which one could put York Minster and still have room to spare. But figures alone can convey no impression of that immense underground hall, with the ceaseless waters crashing through the hole in its roof. A strange blue light comes down the main shaft, and through it the falling waters gleam silver.

Various subterranean passages, worn out by the ceaseless action of the waters, honeycomb the ground, and many of these have been examined and charted for a distance of almost two miles. Many beautiful stalactites and stalagmites are to be found in these passages. Stalactites are icicle-shaped growths of limestone, and have been formed by the evaporation of water, saturated with calcium bicarbonate, dripping from the roof of the cave; the stalagmite grows upward from the floor, and is the result of the stalactite's own deposit. From time to time discussions arise as to the length of time involved in these strange accumulations, but it is impossible to make anything like an accurate estimate of this, as the rate of growth varies from time to time through changes in the amount of lime contained in the water, and the varying direction and volume of the watercourses.

Some two and a half miles to the north-east of Gaping Gill is Alum Pot, which is about 200 ft. deep. An attempt to reach the bottom of this pit was made in 1847, but it was not until 1870 that

Professor Boyd Dawkins, aided by a windlass and the navvies working on the Settle-Carlisle railway, accomplished the feat.

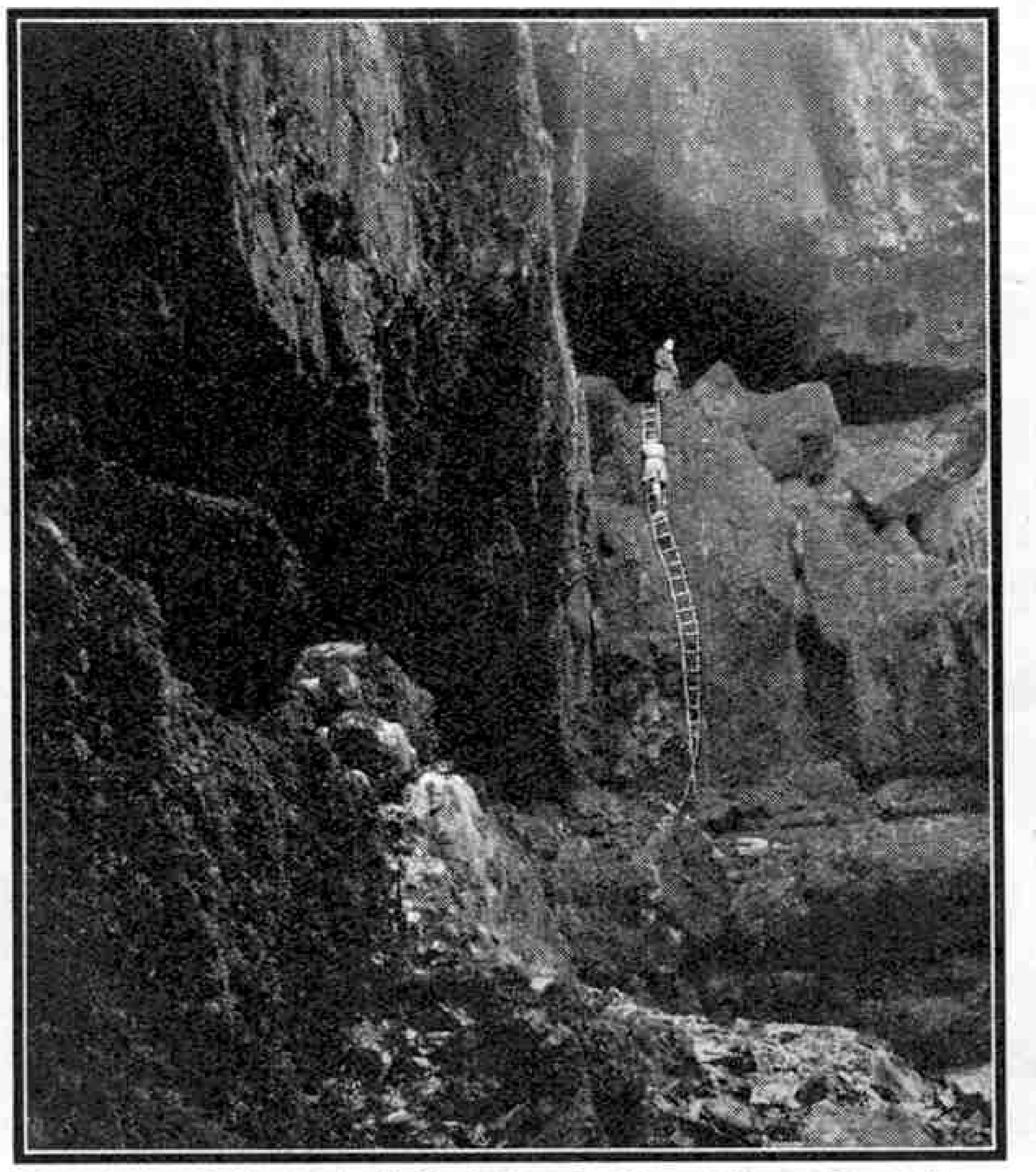
If you have no objection to getting your feet wet you can gain some idea of what this pot-hole is like by exploring Long Churn Passage, which leads into the main shaft, and the entrance to which is some 150 yards above Alum Pot. Although no elaborate equipment is necessary to do this, care is essential as there are some small rock-pitches to be negotiated, and one or two rather deep pools to be crossed. I would advise the newcomer to cave-exploring to leave the deep 60-ft. fissure of Long Churn Chimney into the main shaft alone; but by standing on the rocks beside it you can get a wonderful view through the inky darkness to where a shaft of light streams down into the shaft of Alum Pot.



A Pool, known as "Dr. Bannister's Handbasin," in the Alum Pot cave.

One of the most interesting valleys in Craven from a cave-exploring point of view is the Dale, or Doe, Beck, which rises on the southern slopes of Whernside and flows down between that mountain and Ingleborough, in the direction of Ingleton. This stream has a trick of constantly disappearing into the ground to follow strange subterranean ways, and then coming to the surface again.

About a quarter of a mile below the Hill Inn at Chapel le Dale a sign indicates the way to "Weathercote Cave," which is one of the most interesting features of this valley. A small charge is made to see it, and the proceeds go to St. Dunstan's.



The entrance to the main shaft of Alum Pot from bottom of Long Churn Chimney, by rope ladder descent.

Passing through the gateway into the enclosure, you come to a deep black cavern with the deafening roar of an unseen waterfall adding to the erie fascination of the scene. Some rough-hewn steps lead into the pit, and then, passing under the arch, you come to the second part of the cave where the waterfall, a mad, angry torrent, leaps out of a yawning black hole and plunges over a 77 ft. fall of sheer rock to disappear into a subterranean river again.

From Weathercote you can follow the dry bed of the river upward until eventually you come to the spot where it commences its long underground journey among a series of limestone clints. Still proceed up the dale, and after about a quarter of a mile you reach Gatekirk Cave where the river comes out of a magnificent archway. There are two entrances to this fine looking cave. One is along the riverside and the other a little way to the left. Be careful if you decide to enter by this latter way; after about three yards there is a sudden drop of about 15 ft. to the stream bed.

My last visit to Gatekirk was on a day following heavy rain and the beck was in spate. We managed to scramble along the rocks to the right of the stream for a little way, and then turned off into a subsidiary passage on the same side. After crawling on here for a little way the passage became too low for us to proceed farther, but another opening on our left looked promising. We crawled through and found ourselves in a little chamber, the roof of which contained some lovely stalactites. Out of this a passage led us on to a sandbank beside the main stream again. We stood there for a while gazing at the magnificent sight of the stream pouring out of the graceful arch at the opening of the cave. Upstream all was strife and unrest. On one side another stream hurled itself out of a side passage with a deafening roar, and as far as could be seen was a succession of fierce rapids. It was impossible for us to venture in that direction that day, so we turned our steps and found that straight behind the sandbank was another passage which led us out into daylight once more.

On the hillside behind the Hill Inn is another cave which can be visited without elaborate equipment. This is Douk Cave, and is a very wet specimen of its kind indeed. About 20 yards above the inn a step stile leads over the wall, and the ensuing track is followed upward for a couple of fields' length. The cave lies in a hollow slightly to the right, and has been walled round to prevent cattle and sheep from falling into what at first sight looks like a disused quarry, but is actually a result of faulting, that is, the slipping, long centuries ago, of the rocks that form the strata of the mountain.

Looking over the wall you will see the entrance to the cave in front of you. A stream pours out of it, and you will have to scramble up beside a waterfall in order to gain access to it. Wading in the stream bed is the only possible means of exploring this cave, and I have known the water be waist high after rainy periods. After about twenty or thirty yards you will be surprised to see daylight streaming in. Here the roof of the cave has tumbled in, and you are at the foot of a deep, narrow rift, with vertical limestone walls on each side. Do not try climbing up these; the hand and footholds are very insecure.

Beyond the rift there are some deep pools to be negotiated. I once visited this cave in company with a friend who had a rooted aversion to walking through any more water than was absolutely necessary, and at this point he decided to proceed straddlewise above the stream, looking very much like a huge spider. In time, however, the width became too great for his legs, and he was forced to descend into the stream at one of its deepest places!

There are no side passages in this cave, and you can go upstream for a very long way before you need resort to crawling. There are some very fine stalactites to be seen inside Douk.

In the same vicinity you will find the White Scar Caverns, which were only discovered about 10 years ago, and have since been opened up and illuminated so that all can see their beauty. A guide is in attendance to show visitors round, and the whole system is lit up by electric lights. The underground waterfalls extend for nearly a mile in length, and at the far end of the caverns is a newly discovered lake over which parties can be ferried by arrangement.

There are other caves in Craven which can be entered under the supervision of a guide, such as the Stump Cross Caverns on the Grassington-Pateley Bridge road, which contain some of the finest stalactites and stalagmites in the county; and the Ingleborough Cave, near Clapham. These are admirable places for those who do not wish for the thrills and excitement of the explorer, but nevertheless would like to see some of Yorkshire's wonderful underworld.

In conclusion, I would point out that cave exploring is not a pastime for the individual. One or more companions are necessary,

The Development of Stainless Steel

Interesting Facts about a Wonderful Alloy

ORDINARY steel such as is used for bridges, ships' plates and frames, structural girders and the like, consists of about 99 per cent. iron, together with .25 per cent. carbon, .15 per cent. silicon, and perhaps .60 per cent. manganese. For certain purposes such steel is not entirely satisfactory, however, and in the search for a more suitable material there have been developed "alloy" steels containing often considerable percentages of nickel, chromium, manganese, tungsten, cobalt, molybdenum and vanadium. One alloy steel has been produced that possesses a tensile strength of more than 100 tons per sq. in.; another, used for crushing machinery, actually becomes harder the more work it has to do; but the greatest metallurgical achievement of the last 25 years is probably the development of stainless steel.

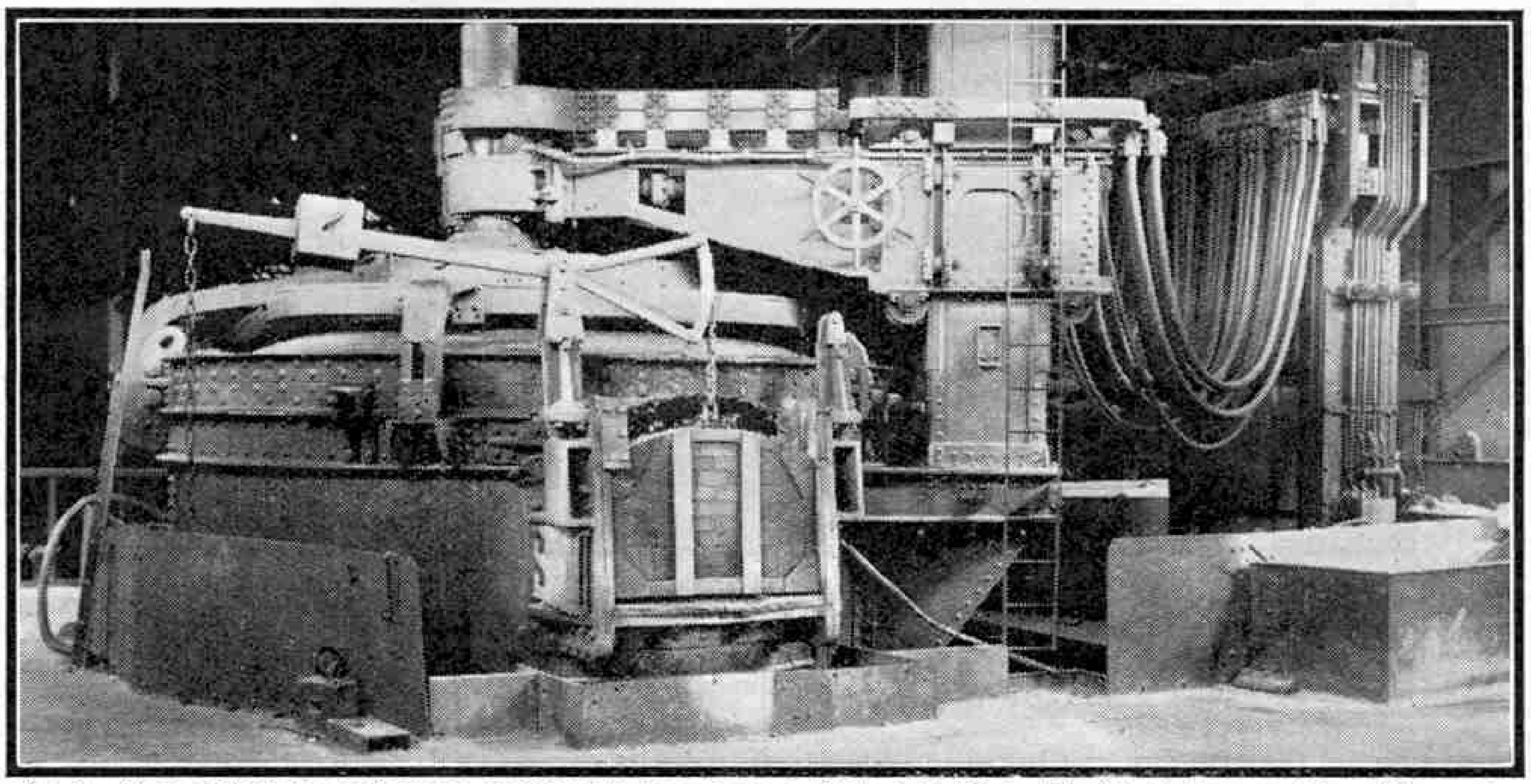


Fig. 1. 30-ton Electric Arc Furnace used for the manufacture of Staybrite Steel. The illustrations to this article are by courtesy of Firth-Vickers Stainless Steels Ltd., Sheffield.

It has been estimated that several million pounds are lost every year simply as the result of the ravages of rust and corrosion. We are all familiar with the sight of rusted knives, rusty railway lines, and rust on ships' plating; and there are many cases in the chemical industries and elsewhere that we do not usually see, where tanks, pipes and valves are pitted and actually eaten away by the corrosive attack of acids. By the suitable addition of alloys to the steel its inherent properties are fundamentally altered, and according to the alloy additions it contains it is made proof against rust, sea-water and even acids, including strong nitric acid and boiling acetic acid.

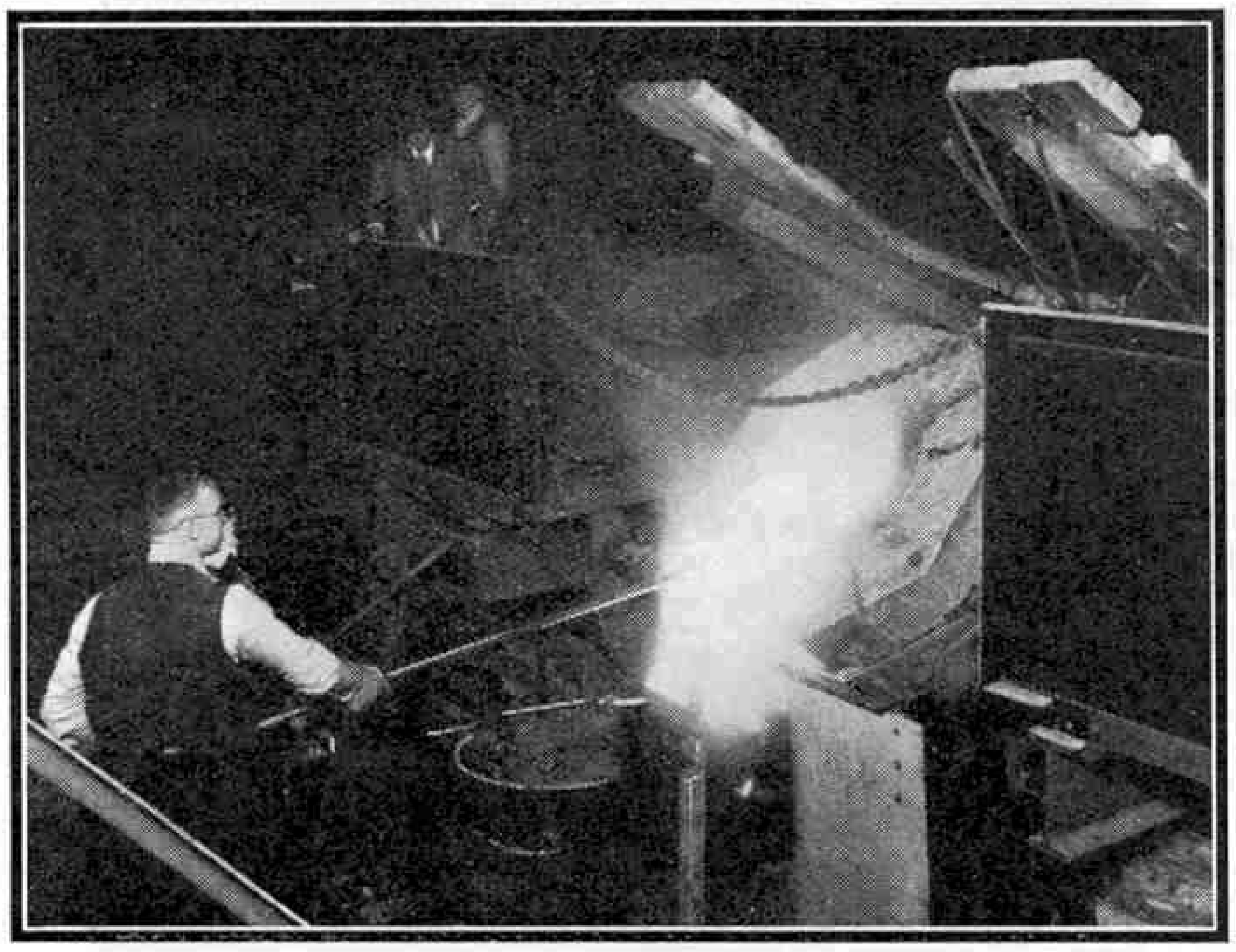


Fig. 2. Tapping a one-ton High Frequency Furnace.

Chromium and nickel are the principal alloy elements used. Chromium occurs naturally as the oxide found in the earth in combination with iron oxide, in a mineral called chromite. It is mined in New Caledonia, Rhodesia, Turkey, Russia, California, India and one or two other places; and an iron-chromium alloy known as ferro-chromium is obtained by reducing the ore with silicon and carbon in electric furnaces. Nickel occurs mainly as the sulphide, in Ontario, Canada, and is reduced to the pure metal either by smelting or by a complicated chemical procedure known as the Carbonyl process.

Both chromium and nickel are found in sufficient quantities in the Earth's crust; but the cost of mining the ores, reducing the metals, and then making and working the alloy steel, is such that it is not economical to replace all ordinary steel with the stainless variety. Rustless ships, for example, remain a dream of the future. Nevertheless, rustless and acid-resisting steels are used to-day in applications as far apart as cutlery and surgical instruments, motor boat propellers and yacht fittings, domestic hollow ware and huge pieces of chemical plant weighing several tons.

Let us now consider the effect of these various alloy additions in modifying the properties of ordinary steel and the origin of stainless steel itself. It has been said, not wholly without foundation, that stainless steel was first discovered in a Sheffield steelworks laboratory by accident. A steel containing chromium had been made and, after testing, a piece was thrown away. It was then noticed that this steel had not rusted like the other pieces of steel on the heap; and subsequent research showed that steel containing from 12 to 14 per cent. of the metal chromium was immune from ordinary rusting when exposed to wind, rain, ice or snow, and was free also from certain other types of corrosion.

This was a great discovery, and 12 to 14 per cent. chromium stainless steel is now used in nearly every household in the form of stainless knives. It is employed also by surgeons and dentists for surgical and dental instruments, and for ordinary pocket knives. In engineering it is used for steam valve seats, because it avoids the pitting caused in ordinary steel by high pressure steam; and it is used for golf ball moulding dies and other dies for rubber and plastics because it retains its high polish.

The steel can be hardened to a razor temper, and is actually used for razor blades; but is more often put into service with a tensile strength of 40 to 50 tons per sq. in., that is, a strength equal to that of the usual alloy steels used for such parts as motor car front axles and railway locomotive connecting rods.

If the chromium addition is raised from 12 to 14 per cent. to as high as 18 per cent., and 2 per cent. of nickel is also added, the properties of the steel are considerably modified, and a special type of stainless steel, with a limited but valuable field of application, is produced. Its tensile strength is a little higher than that of ordinary 12 to 14 per cent. chromium rustless steel, and its corrosion-resisting properties also are improved. It is used mainly for various machined fittings on aeroplanes.

Steel for these purposes is supplied under the Air Ministry specification S.80, and consequently this alloy containing 18 per cent. of chromium and 2 per cent. of nickel is frequently called "S.80" steel. It is used for many purposes other than for aircraft, however. Mr. Scott-Paine, in his record-breaking run at Venice, when his motor-boat *"Miss Britain"* touched 111 miles an hour, used a propeller shaft made of S.80 steel; and as an example of a very different kind of application, it is used for spindles in ice-cream making machines.

We now come to the latest and most remarkable type of stainless steel. This is the type containing 18 per cent. of chromium and 8 per cent. of nickel, which is familiar under its more usual name of "Staybrite." As regards mechanical properties, its strength is a little below that of ordinary alloy steel, but its ductility is very much greater. If a bar of ordinary steel of similar tensile strength is pulled until it reaches breaking point, it will have stretched about 25 per cent. "Staybrite" steel, however, will stretch 60 or even 70 per cent. of its original length before fracture occurs. This gives some idea of its amazing ductility, but it is not on account of its mechanical properties, but for its corrosion-resisting properties, that this steel is so valuable.

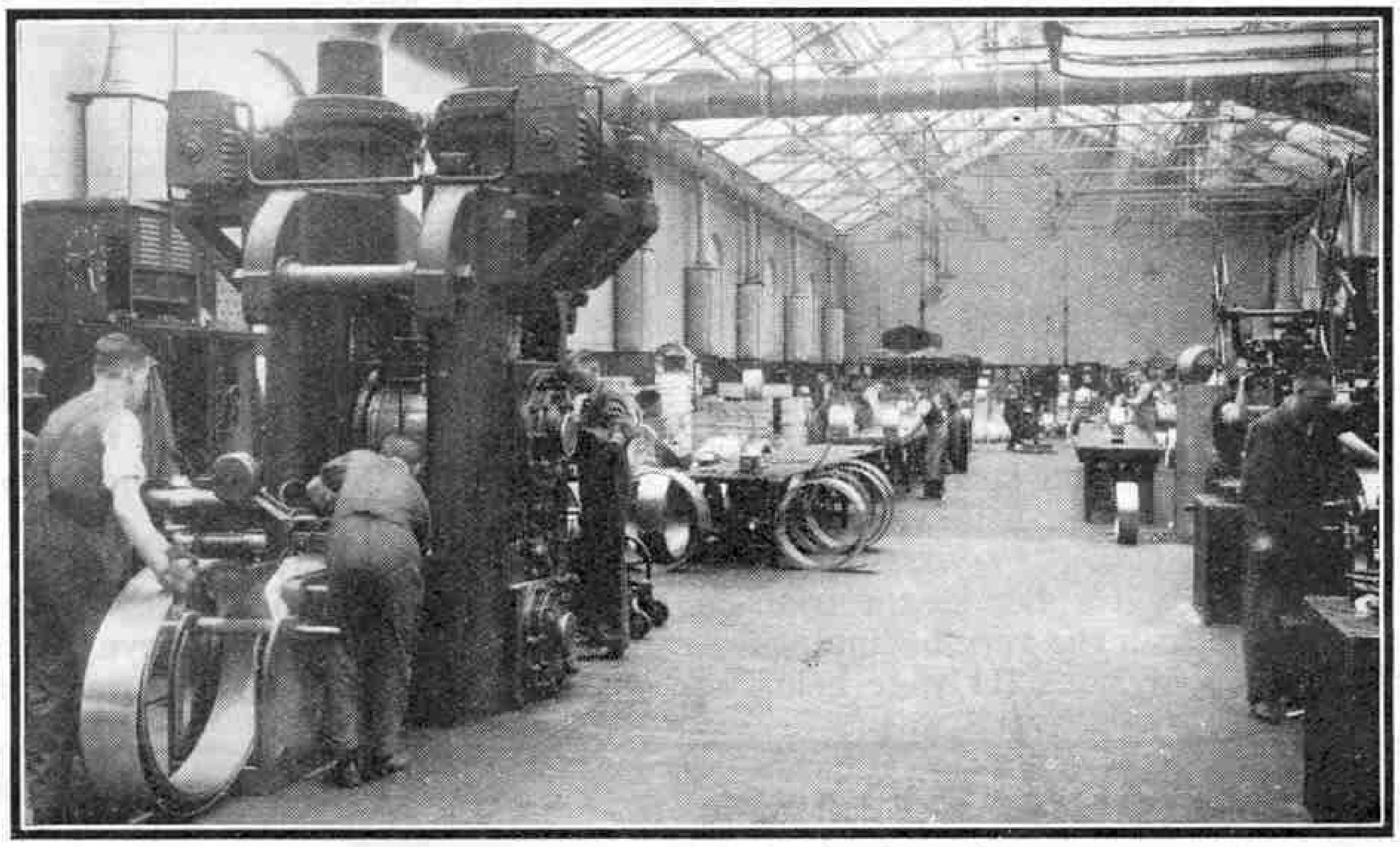


Fig. 3. Rolling stainless steel strip for aircraft manufacture.

Straight chromium rustless steel resists ordinary weathering and certain other corrosive media, and S.80 steel resists sea-water as well; but "Staybrite" steel goes still further, and is acid-resisting. This means that it can be used in contact with most mineral and organic acids, even at high concentrations and high temperatures; as well as with many other corrosive agents that would attack and ultimately destroy ordinary steel. Let us consider for a moment what this means in practice.

In the chemical industries the manufacture and handling of nitric acid and nitrates is an important matter. Even strong nitric acid can be handled by "Staybrite" steel, and storage tanks, transport tanks, pipes, pump parts, valve parts and other details are now made in this material.

In the past, dye-vats used to be made of wood. This was satisfactory up to a point, but had the obvious disadvantage that when the vat was emptied of one coloured dye and another was put in, traces of the first remained soaked in the wood and contaminated the second. Dye-vats, winches, rollers, steaming cans, pumps, valves, and all the other paraphernalia of the dye-works are now made from "Staybrite" steel.

Every day thousands of gallons of milk are carried to London by train or road tankers. These tankers are made from "Staybrite" steel and ensure absolute cleanliness.

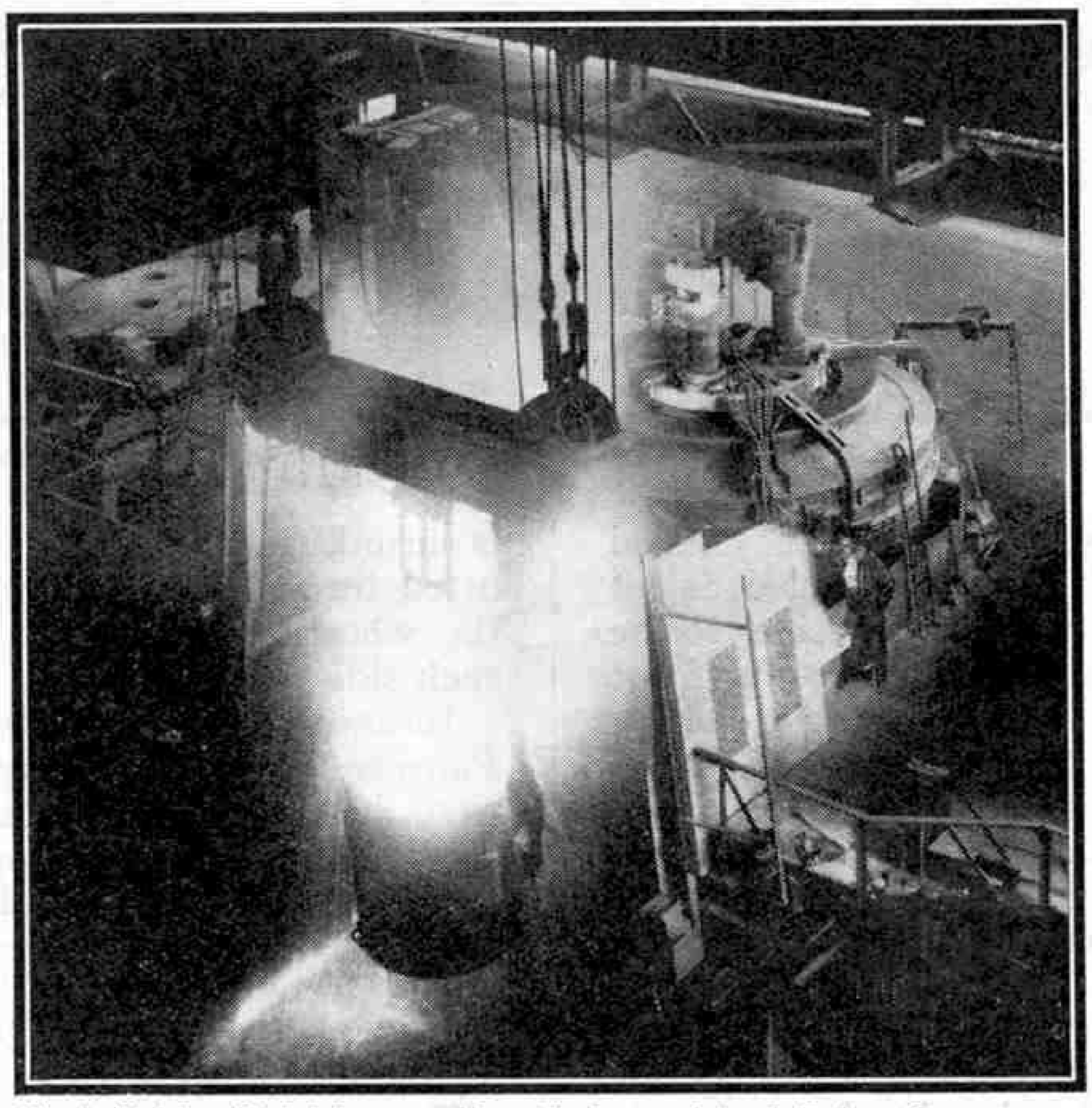


Fig. 4. Stainless Steel being poured from the furnace into a ladle hung from a crane.

One could go on for a long time discussing the many uses of this wonderful new steel. Many readers will have seen it in shop-fronts, lift gates, furniture in modern houses, clock faces, and camera fittings. They will have sat down to a meal prepared in "Staybrite"-fitted restaurant kitchens, cooked in stainless steel pans and eaten with stainless steel knives and forks. They will have seen it in the radiators, hub-caps, and other bright parts of many motor cars, and will have seen stainless steel aircraft in the air above their heads.

The application of stainless steel to aircraft in recent years is one of great importance. For many years spruce has been used for the airframe, and has given splendid results; but there is an obvious risk in using a fibrous material such as wood. No matter how carefully it is selected, there is an ever-present danger of premature failure from shakes and other imperfections of the grain. The use of ordinary steel and the light aluminium alloys overcomes this difficulty, but opens up a new set of dangers due to corrosion. When the fabric covering is stretched over wings and fuselage, the pilot wants to be certain that rust and corrosion have not weakened the structure where it is not seen; his life depends upon it. Only by the use of stainless steel can absolute certainty be attained. The 18 per cent. chromium, 8 per cent. nickel steel is produced in several forms specially for aircraft.

It will be of interest now to describe very briefly how stainless steel is made.

Reference has already been made to the occurrence of chromium and nickel as minerals in the earth and how they are reduced to the alloy, ferro-chromium, and to metallic nickel respectively. These two alloy materials and ordinary steel scrap form the basis of the process. Steel scrap, that is to say odd-shaped and comparatively worthless pieces of steel obtained as scrap products in other parts of the steelworks, is charged through the door of an electric arc furnace. The big 30-ton furnace used by Firth-Vickers Stainless Steels Ltd., is illustrated in Fig. 1. Sticking through the roof are three carbon electrodes—only one can be seen but there are two more behind it—and one phase of a three-phase electric power supply is connected to each electrode. The electrodes are then lowered until an arc is struck between them and the steel on the bottom of the furnace.

If we take an ordinary flash-lamp battery, hold a piece of carbon rod against each terminal, and touch them almost together, we shall obtain a very small arc. This is the principle on which the furnace works, only on a much larger scale.

Each electrode takes about 15,000 amperes, and the whole furnace consumes something in the order of 6,000 kilowatts, or just 100,000 times as much power as a bright electric lamp. The intense heat of the arc melts the steel in two or three hours. Ferro-chromium and nickel are then put into the furnace, together with some ferro-silicon and ferro-manganese, in quantities calculated to give the exact analysis; and the slag covering over the metal is adjusted in composition to refine the steel. After a refining period, during which time the steel is degasified and deoxidised, samples are taken out of the furnace, and when these have shown the condition of the steel to be right, the whole furnace is tilted forward and the steel is poured out into a ladle suspended from a crane above (Fig. 4). The molten metal is then poured into moulds, forming lumps about 1 ft. square by 4 ft. long, called "ingots." Fig. 2 shows the steel being poured out of a smaller furnace of a different type.

The ingots are then pulled out of the moulds and examined. Next they are heated to a good red heat and rolled down to bars or slabs, and later still further to rods, sheets or strips.

This concludes our brief and necessarily incomplete account of the development of stainless steels from ordinary steels, and their present-day application and production.

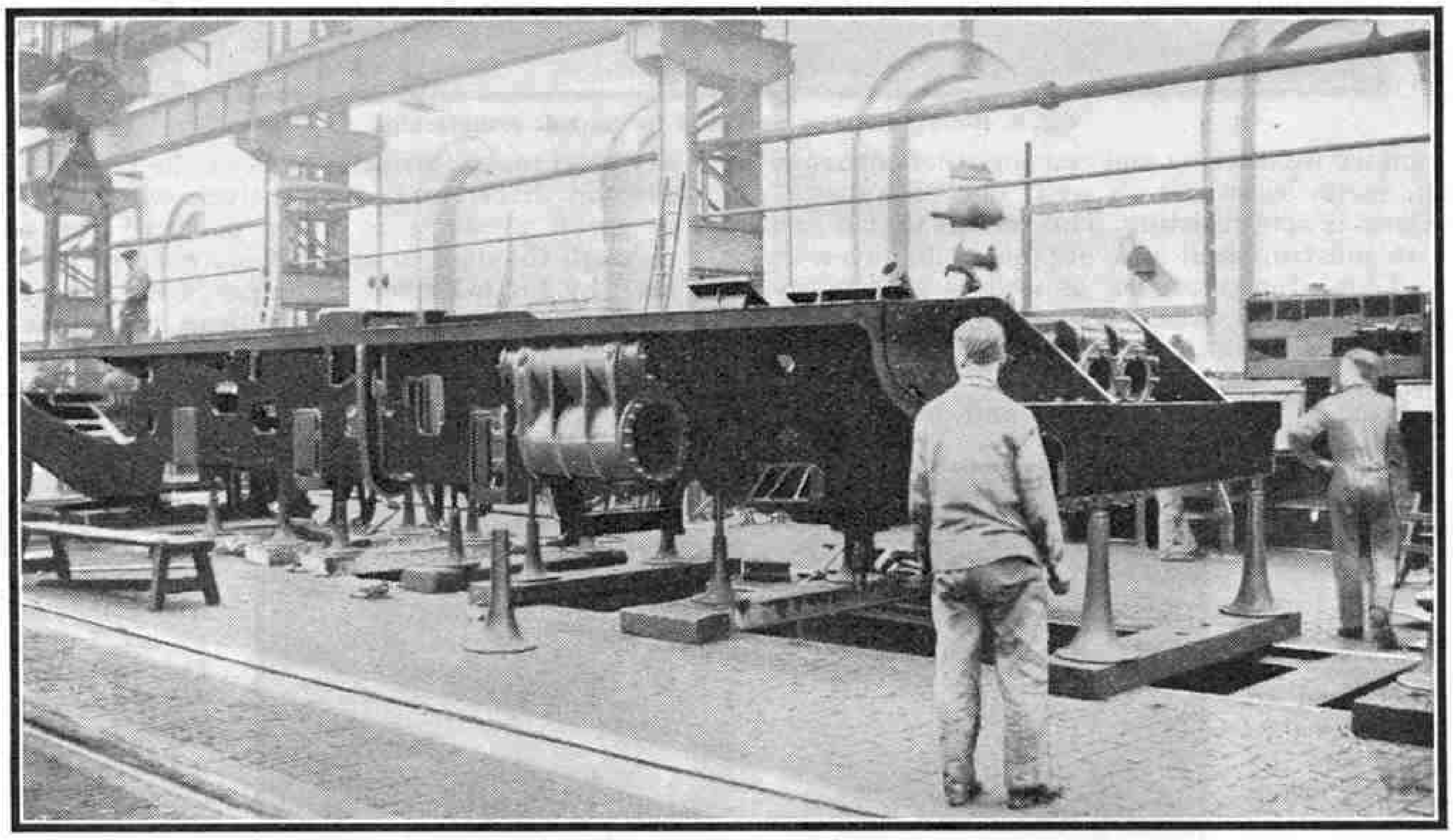
Building the "Princesses" at Crewe

A Fascinating Series of Operations

By a Railway Engineer

THE new batch of ten 4–6–2 locomotives recently completed at the Crewe works of the L.M.S.R. have already established themselves as among the most remarkable engines that have yet run in British high-speed express service. During a visit to the works I was privileged to inspect five of these huge engines in varying stages of construction. The last one to be laid down, No. 6211, was at the time little advanced beyond raw materials, while No. 6207, "*Princess Arthur of Connaught*," was nearly ready for her steam trial.

In the frame shop were to be seen the very beginnings of an engine. The main frames of No. 6211 were being cut to shape with an oxygen flame from steel plate 1⅛ in. thick. In order to save time in marking out each individual frame, a thin steel pattern or "template" is used; and with this shape as a guide a main frame plate can be completely cut out in 3 hours.



The main frames of No. 6209, "Princess Beatrice," with the cylinders in position. These frames form the foundation of the engine and are supported for the time being on jacks.

Some very interesting processes were going on in the boiler shop. The front vertical wall of the fire-box, or tube plate as it is called, is set well forward into what appears from outside to be the boiler shell. This entails making the fire-box front with a very deep flange, the flanging being done by hydraulic presses. The fire-box front or "throat plate" is made out of ⅞ in. thick steel plate, so that the power needed in the flanging operation can be readily imagined.

A short distance away, the boiler of No. 6211 was being riveted to the fire-box casing. The boiler hung vertically over a deep round pit; one man with a hydraulic riveter was inside the fire-box, while the rivets when white hot were placed in position by his mates outside. Then, with the harsh characteristic tattoo of the riveter, intensified doubly in the confined space, each rivet was quickly snapped over by the hydraulic punch, or "head."

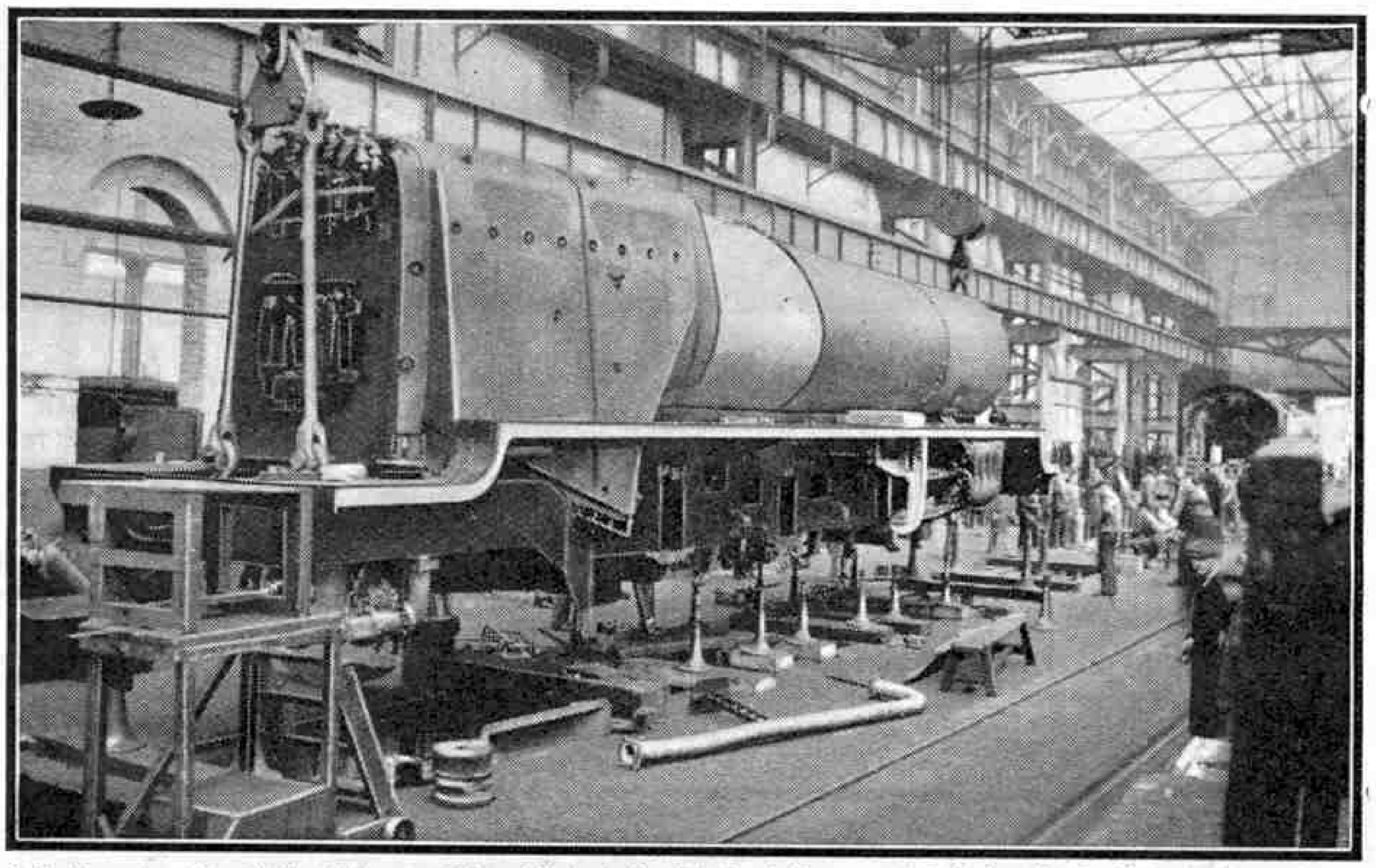
Near by another "Princess" class boiler was completed, while in a testing bay that for No. 6209, "*Princess Beatrice*," was being given its steam trial. It was a most singular spectacle to see this bare shell being fed with water and stoked just as if it were on the finished engine and pulling an express train. The working pressure of the 4–6–2s is 250 lb. per sq. in., but on trial the boiler is steamed at about 260 lb. per sq. in. for an hour.

A striking contrast was provided by the wheel shop. Here, a pair of wheels, which had already been mounted on the axle, were just ready for the tyres to be shrunk on. Lying on the floor of the shop was the steel tyre, surrounded by a ring of gas burners heating it to expand it sufficiently for the wheel-centre to be slipped in. The axle with both wheels attached was hanging from a crane vertically above. As soon as the man in charge judged that the tyre was hot enough, the wheel-centre was gently lowered until it just slipped into the expanded tyre. The gas burners were quickly withdrawn and the tyre allowed to cool. So it shrinks on to the wheel-centre and makes the tightest job imaginable. The tyre is made with a flange on the outer edge against which the wheel-centre fits. After the tyre is shrunk on, a retaining ring, known as a Gibson ring, is fitted into a groove turned on the inside rim, so that the wheel-centre is held between two flanges, one on each side of the tyre.

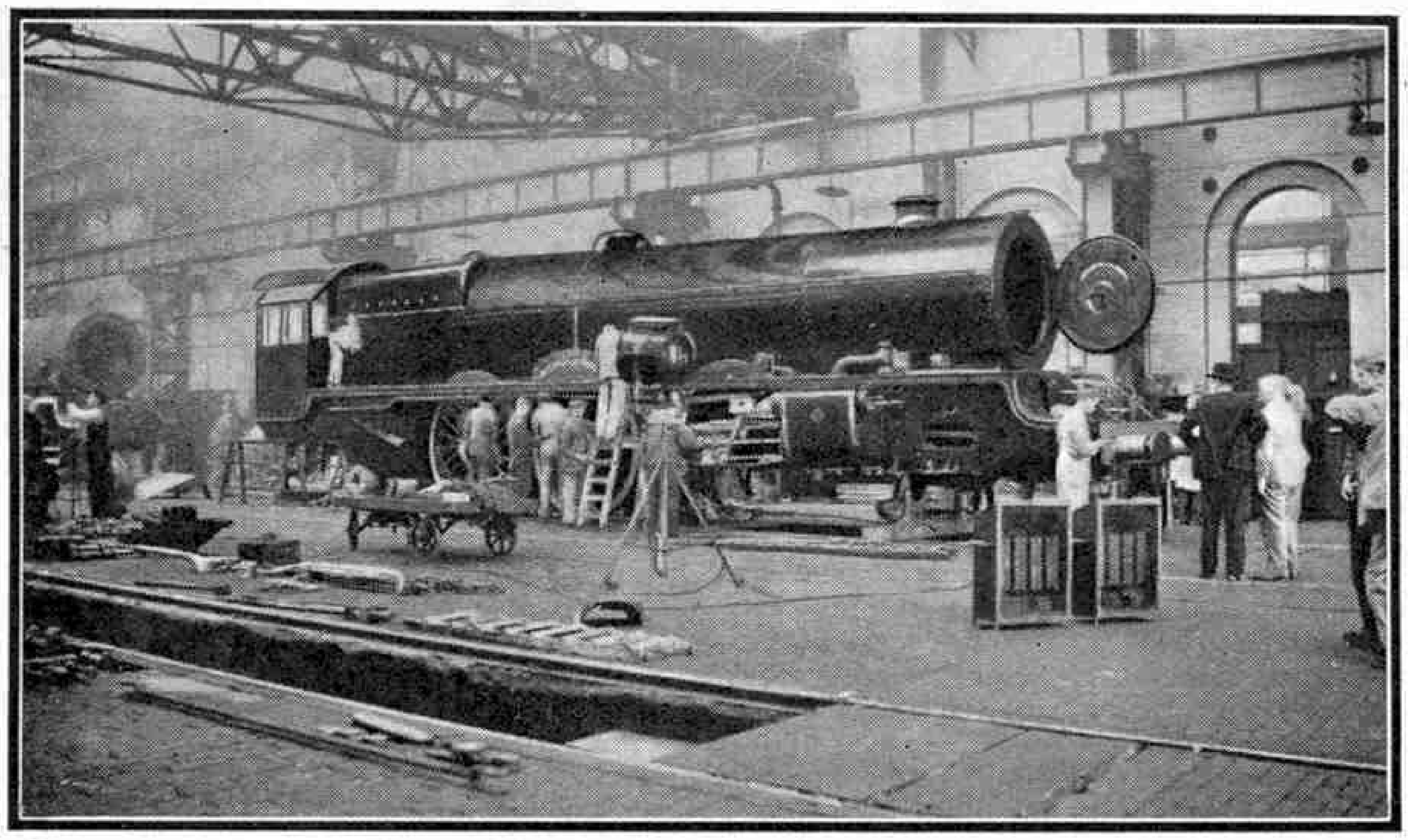
In another shop the frames of engine No. 6210, "*Lady Patricia*," were beginning to take shape. The cylinders were being fixed in position, and the erectors were making almost microscopic adjustments to get their centres dead square with the axle-box guides. I was interested to see that most of the riveting on the main frames were done "cold." The rivet heads were formed by a cup-shaped tool called a "snap," which was struck by terrific blows with a sledge hammer.

Most fascinating of all however is the erecting shop proper. At Crewe, the "belt" system is in use. The basic principle of this method of erection is that in each part of the works you have gangs of men who are specialists in some particular phase of locomotive building; by careful organisation, a steady stream of work is brought to those men in their particular bay, and when their task is completed the engine is moved on for the next stage. Crewe provides the first and only example in this country of its use in locomotive erection and in the case of the "Princess" class, has achieved its greatest triumph yet, by turning out one engine every 5½ days—a world's record.

On the occasion of my visit there were three engines on the belt, Nos. 6207–8–9. The last of these had only just arrived from the frame shop, and preparations were being made to receive the boiler. In the case of No. 6208, "*Princess Helena Victoria,*" the first stage of erection had just been completed, the boiler was mounted on the frames, and two huge 50-ton overhead travelling cranes were being manœuvred into position above ready to move it on to the next bay. Their great lifting hooks were adjusted until the engine was fairly and squarely held at the footplate and buffer-beam, and then, at a whistle from the man in charge, the engine was hoisted into the air.


A further step; No. 6208, "Princess Helena Victoria," with the boiler mounted, being lifted off the jacks ready to be taken along to the next stage of erection on the "belt."

Until an engine is placed on its wheels, it is supported at the correct height above the rail level by a number of jacks, each of which has a forked bearing into which the engine frame fits. In the bay ahead, to which No. 6208 was about to be moved, 20 men were lined up to receive it, to guide the frames into the jacks. The "right away" signal was given to the cranes, and the half-finished engine, which already weighed almost 100 tons, glided smoothly along the shop. For a moment it hung in mid-air over its new position, and then it was carefully lowered to within an inch of firm support. The jaws of each jack were set to fit the frames exactly, and then the two cranes, working in perfect synchronism, very gently delivered their burden. The complete move from one bay to the next took a little under five minutes.

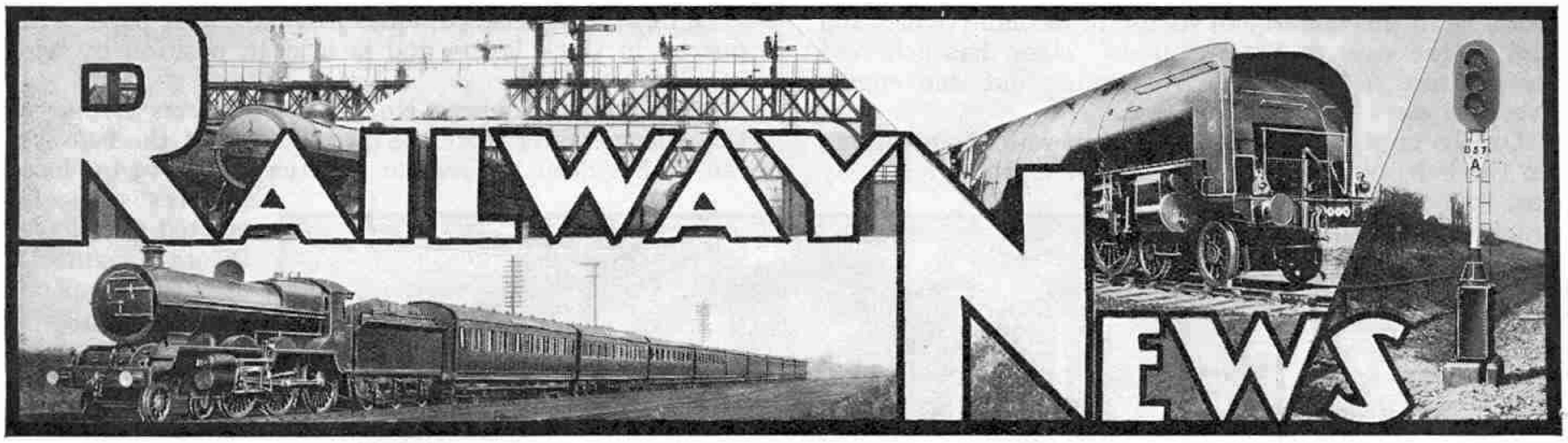

No. 6207, "Princess Arthur of Connaught" at an advanced stage of erection. The centre pair of coupled wheels is raised up slightly to allow of their rotation for valve setting, without the necessity of moving the engine.

One of the first jobs to be done in its new position was to fit the outer clothing sheets of the boiler. Between the boiler barrel proper and the outside casing is a hollow shell, which prevents heat leaking away by radiation. In addition to this the boiler itself is completely wrapped with insulating material; in the case of the 4–6–2s this "lagging," as it is called, looks just like silver paper. It is put on in thick layers and is held in position by wire netting.

In the final bay was No. 6207, "*Princess Arthur of Connaught.*" Ever since the introduction of the belt system it has been the regular practice at Crewe for locomotives to be erected completely before painting, each engine spending practically a week in the paint shop after erection is complete. But in the case of the new 4–6–2s painting has been carried out as part of the work in the final bay, and at the time of my visit No. 6207 was resplendent in crimson lake. The driving wheels were under the engine, and the erectors were engaged on one of the most vital operations in locomotive building, that of setting the valves, so that they move in perfect synchronism with the pistons. For this purpose the driving wheels were raised an inch above rail level, and supported on screwed jacks so that they could be turned to any amount required without moving the engine.

On the footplate, men were fitting various gauges; the reversing gear by which the driver adjusts the cut-off of steam in the cylinders was in place; and carpenters were putting in the footplate floorboarding and fitting the tip-up seats for the driver and fireman. Underneath the fire-box, a pair of erectors were fitting the dampers, and another gang were at work on the lubrication system. On the finished engine all the pipes are so neatly hidden away that its extent is hardly realised. During assembly, however, the space just under the running plates is a perfect mass of pipes, all dangling loose and unconnected.

Leaving the works, I was just in time to witness the final phase in locomotive construction. In Crewe station was No. 6206, "*Princess Marie Louise,*" in process of being "broken in." For a week or so after leaving the works all new engines are run on light slow trains. On this occasion No. 6206 was hauling a local train of six coaches destined for Liverpool.



Success of "*The Silver Jubilee*"

From its introduction the L.N.E.R. express "*The Silver Jubilee*" has been most successful in operation. The service has been well patronised, and on almost every journey it has been necessary to make use of the third-class restaurant car as part of the seating of the train. The timekeeping has been excellent, and it is evident that the locomotives have ample margin for time recovery from delays en route.

As might have been expected, the departure of "*The Silver Jubilee*" from King's Cross has become one of the sights of London, and crowds gather nightly to see it. At Darlington, too, the only stop during either up or down journeys, the arrival and departure of the train are evidently popular events, as the sale of platform tickets there has increased practically threefold since the commencement of the service. Newcastle also shares in this enthusiasm.

The second of the streamlined "Pacifics" designed for this service, No. 2510, "*Quicksilver*," did not make its first run on "*The Silver Jubilee*" until the middle of October. Thus, for the first fortnight of the running of the train, No. 2509, "*Silver Link*," had to perform both up and down journeys, travelling 536.3 miles each day at an average speed of over 70 m.p.h. To the great credit of its designer, Mr. H. N. Gresley, its builders, and the locomotive running staff, this arduous task was performed without difficulty. The other two engines of the class are named "*Silver King*" and "*Silver Fox*" respectively.

Before its introduction to "*The Silver Jubilee*" service, No. 2510 hauled a special train from London to York, and the 188¼ miles were covered non-stop at an average speed of 61 m.p.h. The return journey was performed at an average speed of approximately 62 m.p.h.

There are 14 locomotives of the "Sandringham" class under construction at Darlington. They will bear the names of famous Association Football teams.

70 m.p.h. on 3 ft. 6 in. Gauge

The possibilities of higher railway speeds are being explored in South Africa, as in most other countries throughout the world. Up to the present the South African Railways, with the difficulties occasioned by heavy gradients and severe curves on their 3 ft. 6 in. gauge lines, have not shown anything like the average speeds made in Japan and Java on railways of the same gauge, which is standard in each country.

An interesting footplate view showing Driver Duddington, who made the fine run with the Leeds-London "Breakfast Flyer" that was described in the November "M.M.," in the cab of a "Pacific." Photograph by Mr. O. S. Nock.

Recent trials with improved motive power, however, indicate that higher speeds are possible. A British-built 4–8–2 locomotive of Class 19C, with a load of three coaches weighing altogether 131 tons, exhibited great powers of acceleration and showed itself able to maintain speeds of over a mile a minute up gradients of 1 in 80. With 8-coupled driving wheels, 4 ft. 6 in. in diameter, this locomotive reached a maximum speed of 67½ m.p.h.! On this run the 45.3 miles from Wellington to Capetown were covered in 50½ min. net. The fastest existing schedule is 73 min. As compared with earlier standard locomotives of the South African Railway, the engines of this class are provided with rotary camshaft poppet valves and motion, improved balancing and front-end details.

Trials have been made also with the first of a new class of 4–6–2 locomotives, built by Henschel and Sohn in Germany. This class is known as 16E, and the engines have coupled wheels 6 ft. in diameter. With a load of eight coaches, over the same route as in the test mentioned above, fast running was performed and a measured mile was covered at 70 m.p.h. Thus the engine on its first official trial run equalled the maximum speed record of the South African Railways.

The new 4–6–2 locomotives, designed by Mr. A. G. Watson, Chief Mechanical Engineer and Assistant General Manager of the South African Railways, each weigh 164 tons together with their tenders. The tenders carry 6,000 gallons of water and 12 tons of coal. Owing to the high pitch of the boiler above the rails, the chimney is severely restricted in height, and the safety valves and chime whistle are not mounted vertically on the boiler, but are set at an angle.

S.R. Locomotive Movements

With the electrification of the Eastbourne service, the 3-cylinder 2–6–0 locomotives of class U.1, that formerly were used to a large extent on that route, have been transferred for general duties on the Eastern Section. With them are some of the same class from Fratton, "Schools" class Nos. 924–933 stationed there being now responsible for the Portsmouth trains. The remainder of the "Schools" are distributed as follows: Nos. 900–912 at St. Leonard's-on-Sea; Nos. 913–923 at Ramsgate; and Nos. 934–939 at Bricklayer's Arms.

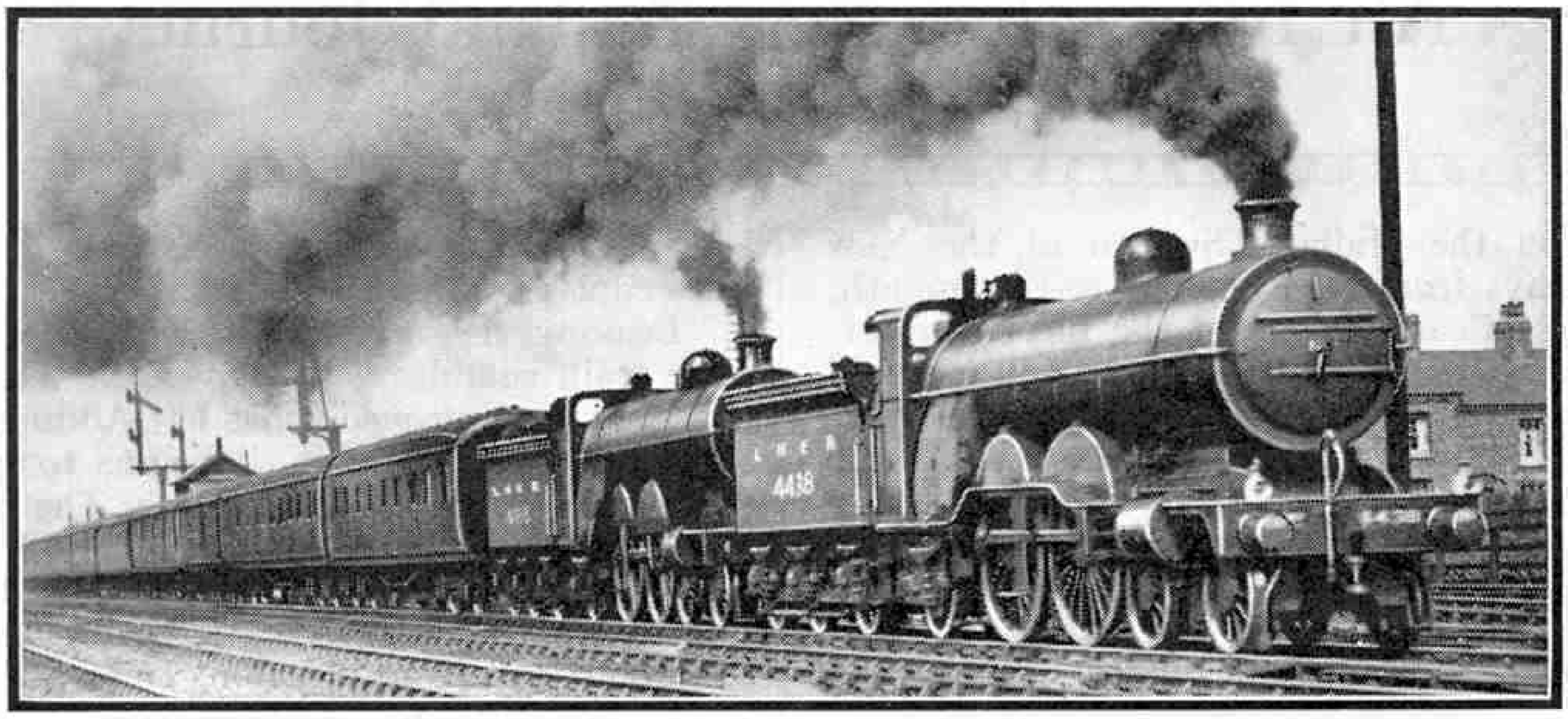
A Locomotive Exchange in Ireland

The famous locomotive exchanges of former years between various companies are recalled by the recent working of an L.M.S.R. (N.C.C.) and G.N.R. (I) locomotive on each other's metals. The engines were respectively No. 96, "*Silver Jubilee*," a new 2–6–0 of the N.C.C., and No. 170, a 4–4–0 of the class responsible for all the important express work on the Great Northern before the introduction in 1932 of the 3-cylinder compounds. Pilotmen accompanied the strange crews in each case.

Southern Railway Developments

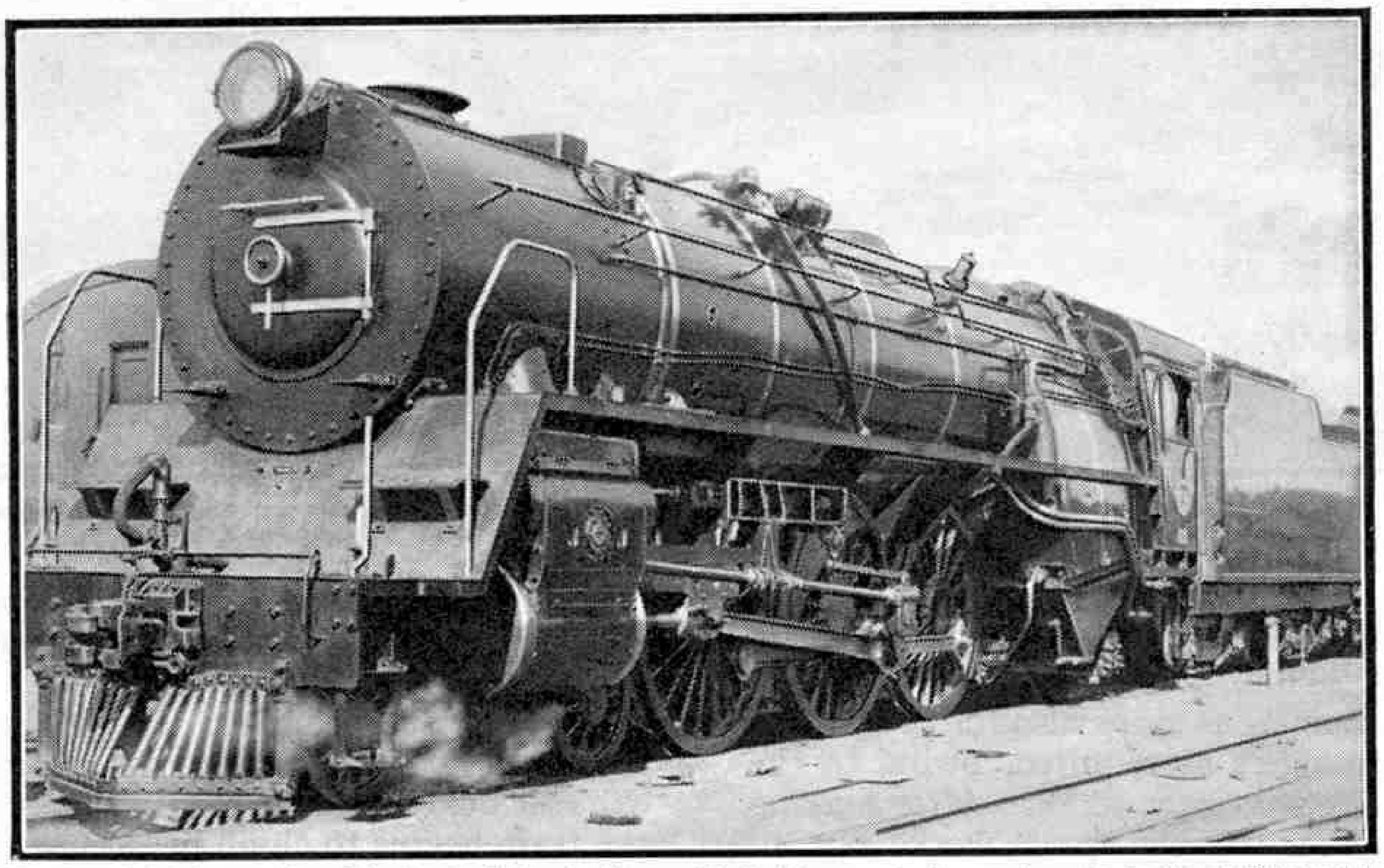
The Southern Railway have put into traffic from Eastleigh and Lancing Works 30 new third-class coaches. These are of the centre-corridor, end-vestibule type, and are chiefly employed on the Bournemouth services. In external appearance they are very handsome and symmetrical, and their internal appointments are thoroughly up to date in all respects. Tables can be erected between the seats, and the wide side windows are provided with "Air-stream" ventilators.

Body construction follows standard practice, in that galvanised steel panelling is laid over the timber framing. The underframes of steel are mounted on standard Southern Railway bogies. A special feature is that the vehicles are bow-ended, and have Pullman type gangways, "Buck-eye" draw and automatic coupling gear, and adjustable side buffers. The coaches have a body length of 59 ft. and are 9 ft. wide overall.



Heavy work on the L.N.E.R. Two "Atlantics" are sometimes used on a heavy train when no "Pacific" happens to be available for the duty. Photograph by C. Ord, York.

As a result of the growth of traffic, especially that induced by the dock extensions at Southampton, the former Southampton West Station has been rebuilt and is known as Southampton Central. Reinforced concrete has been largely used in the rebuilding operations. The whole of the signalling has been renewed and is manually operated from two cabins, points situated beyond the range of hand working being moved by electric motors.



The new 4-6-2 locomotive of the South African Railways, fitted with poppet valves, referred to on the previous page. Photograph by Mr. Garrison of the S.A.R., and forwarded by our reader A. Stephens, of Johannesburg.

The electrification of two short lengths of line, between Lewisham Junction and Nunhead, and between Woodside and Sanderstead respectively, has permitted improved services to be afforded. The former line connects the Charing Cross to Dartford route with that from St. Paul's to Catford, and enables a business-hour service between St. Paul's and Dartford to be operated. This assists in relieving congestion at London Bridge, and Cannon Street. A regular service is operated between Sanderstead, Charing Cross and Cannon Street. The cost of the new electrification works was £233,000, but the ultimate value of these connecting links is much greater than can be estimated merely by the cost or the mileage involved, which was only 4½ route miles. Of these the Lewisham Loop accounts for 1½ miles.

Winter Weather Precautions

Although the climate of this country seems to be milder than it used to be, judging from accounts of railway traffic held up completely by snowstorms in certain districts, it is still very necessary for the railways to be prepared for any sudden visitation of fog, snow or storm. Heavy supplies of the detonators used for fog signalling are required, and on the L.M.S.R. alone some 1,250,000 of them will be used during the winter. In the event of severe fog occurring in districts of dense traffic, special schedules already prepared are brought into force.

Earlier in the year experiments were being made by the L.M.S.R. with two new types of signals intended to minimise the effects of foggy weather on the running of trains. One of the signals is gas-fed, and gives a flashing light at the rate of 120 flashes a minute; the other type projects a powerful electric beam of special design. In both cases these signals are only exhibited during fog, their purpose being to repeat the indication of the semaphore "distant" signals to which they apply.

In addition to the usual precautions, the G.W.R. automatic train control system is extremely valuable in foggy weather, as it gives an audible warning in the locomotive cab of the position of each distant signal. If the line is clear a bell rings in the cab, but if it is not clear a siren is blown and the brakes are automatically applied. This system operates over 2,130 miles of line between Paddington, Plymouth, Swansea and Wolverhampton.

Snow also has to be allowed for, particularly on exposed stretches of line. Snow fences are erected at points on the L.M.S.R. between Perth and Inverness, and between Leeds and Carlisle. At the chief locomotive depots are stationed the snow ploughs used to clear the line. It is interesting to note that near the summit of Drumochter, between Perth and Inverness, where the line is 1,484 ft. above sea level, the risk of snow is such that the signal wires are carried on high posts instead of along the ground as usual.

Brisk S.R. Locomotive Work

The "King Arthur" locomotives of the S.R. maintain their reputation for sound and consistent performance. On a recent occasion, on the 6.30 p.m. from Waterloo, No. 788, *"Sir Urre of the Mount,"* did well with a load of 386 tons tare and 415 tons full. Two severe permanent way checks were experienced, at Wimbledon over the site of the new flying junction, and near Eastleigh; but the intervening work was of a very spirited character. On account of the first check it took 19 min. 43 sec. to pass Surbiton, 12 miles out, but the ensuing 54.7 miles to Winchester were covered at an average of 61 m.p.h. At Weybridge 66 m.p.h. was touched, and the 11.8 miles thence to milepost 31, mostly rising at 1 in 300, took 12 min. 9 sec., with a minimum speed of 52 m.p.h. From Farnborough to Basingstoke the average was 63.5 m.p.h., over a stretch definitely against the engine, although with some level sections.

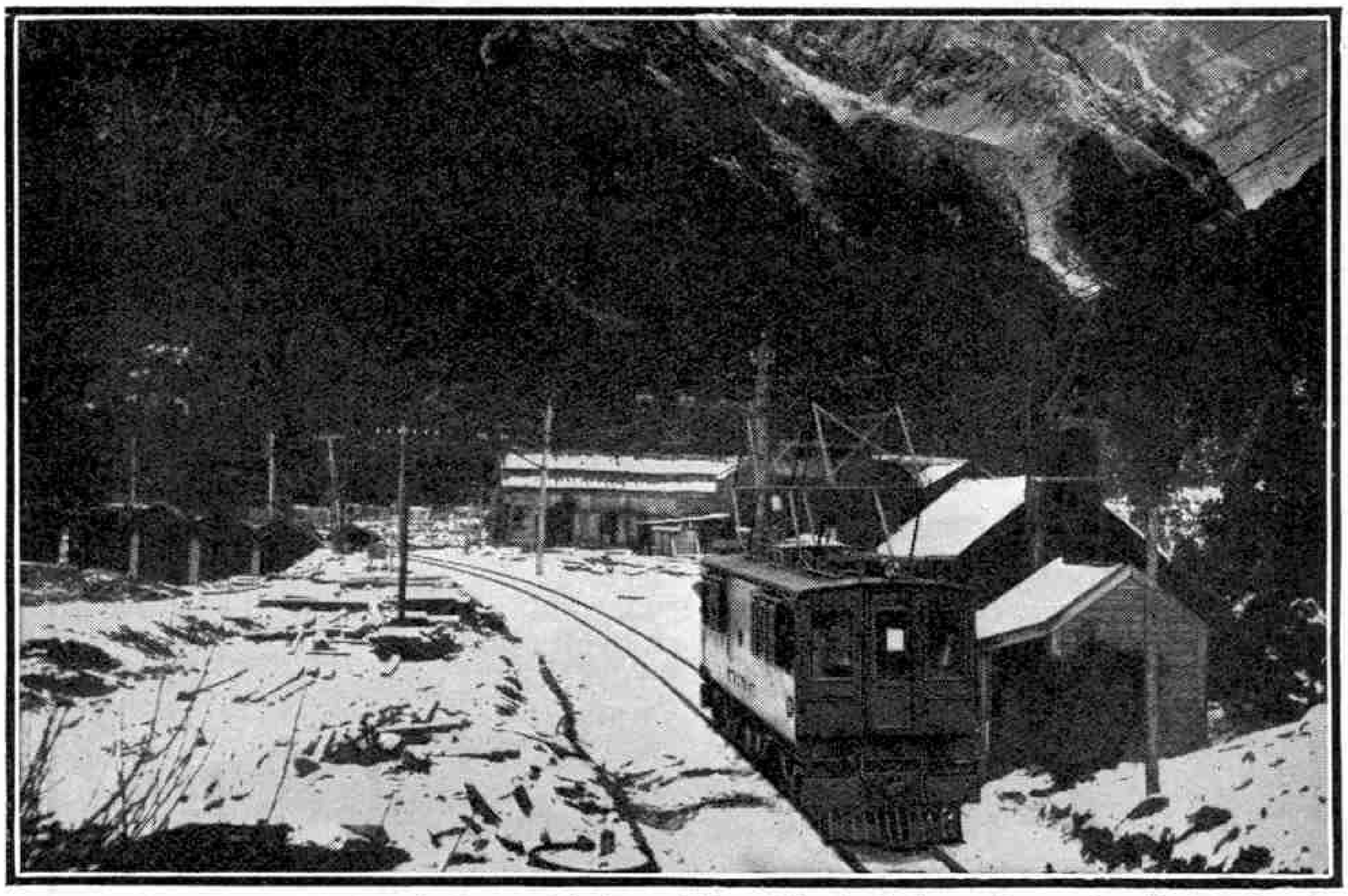
Basingstoke, 47.9 miles, was passed in the good net time of 51½ min. from Waterloo, and on the long climb at 1 in 249 beyond, speed did not fall below 48 m.p.h. On the descent towards Southampton, the 10.7 miles from Micheldever to Winchester were reeled off at an average of 72.7 m.p.h. with a long-sustained maximum of 75. Southampton was reached in 93 min. 35 sec., instead of 88 min. as booked. The net time however was only 85 min.—an excellent piece of work. This run was recorded by Mr. O. S. Nock.

The "*West Coast Express*"

An Interesting New Zealand Journey

By J. Mahoney

THE journey on the Midland Section of the New Zealand Railways from Christchurch to Greymouth, from East to West Coast, is one of the most interesting in the Dominion, both from a railway and a scenic point of view. This line owes its importance to the fact that it is the only direct route for transporting the timber and coal of the West Coast to the East Coast. It is the route taken by tourists going to see the many scenic attractions of the West Coast, including the famous Fox and Franz Josef Glaciers which approach closer to sea level than any others in the world. The scenery en route is as varied as one could wish. Owing to the difficult nature of the country, and the fact that the road is often closed to traffic in the winter owing to slips and washouts, there is very little motor competition. Motor cars, in fact, form a very remunerative part of the traffic of the line, special trains even being run in the holiday seasons for cars only.



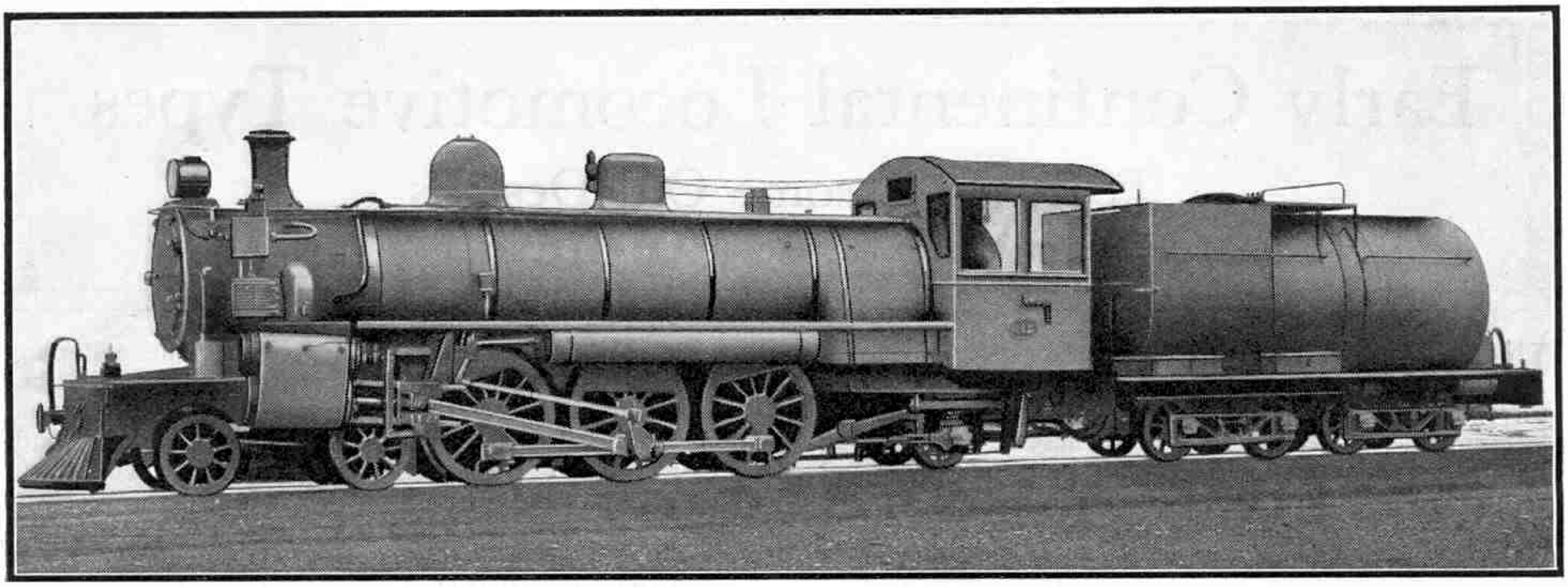
A striking view of the approach to the famous Otira Tunnel. One of the electric locomotives used on the tunnel section is shown in the foreground. These engines are employed in pairs on the "West Coast Express."

The "*West Coast Express*" leaves Christchurch at 10.0 a.m. on Tuesdays, Thursdays and Saturdays, and the time taken for the 145-mile run to Greymouth is 6 hrs. 29 min. including a stop of 25 min. for dinner. There are numerous stops also for picking up and setting down passengers as required, owing to the infrequent nature of the passenger service. After making allowance for stops, the average speed works out to about 28 m.p.h. This is quite a good performance considering the abundance of steep grades and sharp curves on the line in traversing the "Southern Alps."

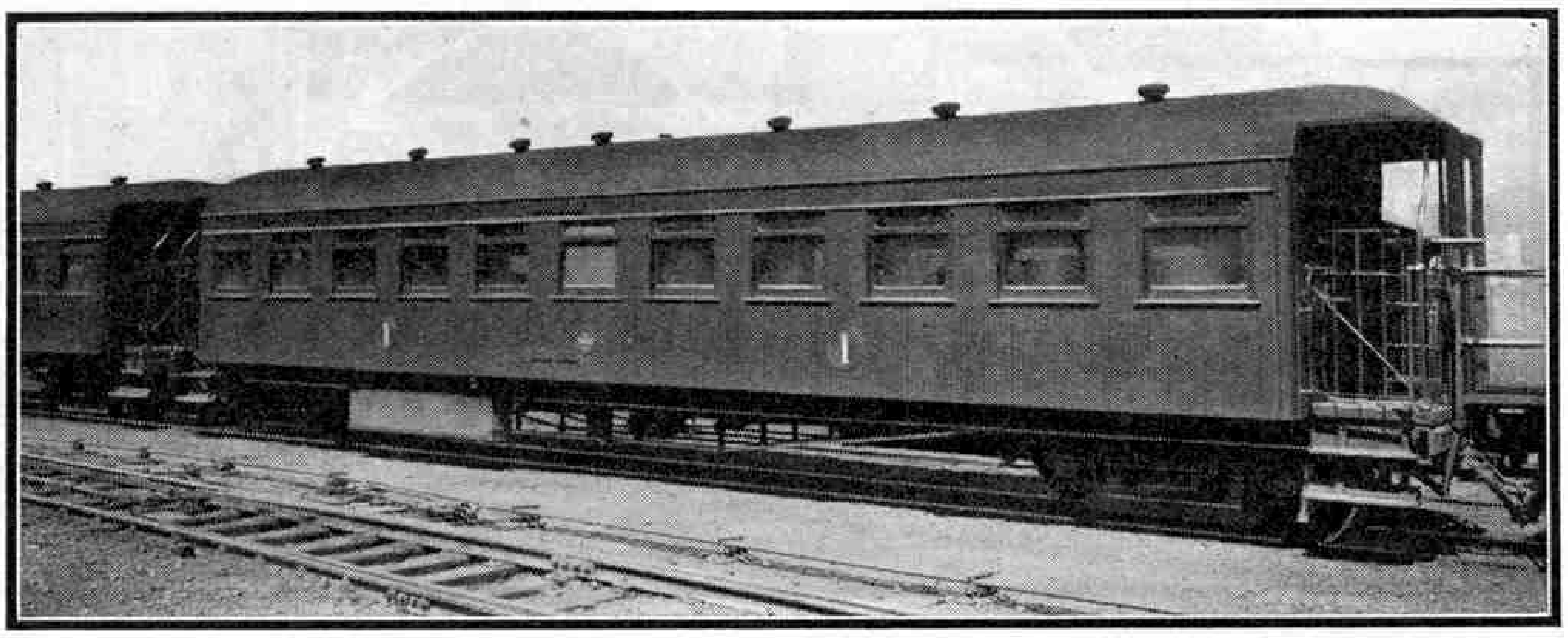
The express usually consists of five open-corridor type cars, each 45 ft. 6 in. long, two first-class and three second-class, and two vans for mail, luggage and parcels. All the carriages are steam heated and electrically lighted, and as they are painted a bright red colour their external appearance is particularly smart. The train is drawn by a locomotive of the 4–6–2 "AB" class, which is still the standard passenger and goods locomotive of the South Island. These 2-cylinder "Pacifics" have a nominal tractive effort of 20,000 lb. and although they have driving wheels of only 4 ft. 6 in. diameter they are capable of high speeds on a level track.

Leaving the main platform at Christchurch Station the train rumbles gently over the many level crossings in the city; but once it has left Addington Junction, one mile from Christchurch, it begins to speed up and soon it is doing from 45 to 50 m.p.h. The main south line to Dunedin is followed as far as Rolleston Junction, a distance of 14 miles. This is a level and straight piece of double track line, so that it is not long before we pass through Rolleston Junction. Here we branch off to the West in the direction of the snow-capped mountains that can be seen in the distance. After an interesting run over the broad wheat lands of the Canterbury Plains, stretching far away into the distance on each side, we arrive at Springfield, 44 miles from Christchurch, at 11.25 a.m. Near Springfield the plains begin to merge into hills. The mountains that we saw in the distance before seem much closer now, and if it is a fine day they present a very attractive picture with their white peaks glistening in the sun.

The halt at Springfield lasts eight minutes, and after taking in coal and water, we resume our journey. The exhaust beat of the engine becomes noticeably louder as the train begins to climb in earnest. In the next 45 miles the line attains an altitude of 2,435 ft., and there is scarcely a mile of level track between Springfield and Arthurs' Pass. The latter is the highest station on the line, and our train passes all the way up through steep river gorges and valleys where a way for the track has been cut only with great difficulty. This section is very expensive to maintain in winter, when the rivers are in flood. As might be expected, the scenery is magnificent here, especially in the Waimakiriri Gorge where the train runs along the side of the Gorge for miles and the river is 200 or 300 ft. below. In the short length of nine miles we pass over four high steel viaducts, one of which is 236 ft. above the floor of the Gorge, and through 17 tunnels.



The express runs into Arthur's Pass station, 2,435 ft. above sea level, at 1.30 p.m. Here two electric locomotives to pull the train through the Otira Tunnel take the place of the "AB" Pacific, which goes back to Christchurch on the Eastbound express. Quite a few passengers may be dropped at Arthur's Pass, as this region is becoming very popular as a winter sports playground, and during the winter season excursion trains are run here on Sundays. The name of this place is derived from Arthur Dobson, who discovered this opening between the mountains in 1863.



In the upper illustration appears a standard 4-6-2 locomotive of the "AB" class. The lower photograph shows one of the standard open corridor coaches. The photographs on this page are reproduced by courtesy of the New Zealand Government Railways.

The Otira Tunnel is the longest tunnel in the British Empire, and is the crowning achievement of this trans-Alpine Railway. It is 5¼ miles in length and accommodates a single line laid to the New Zealand standard gauge of 3 ft. 6 in. It was commenced in 1908, but owing to serious difficulties encountered in boring it was not finally completed until 1923. Operations had to be carried out on a snow-swept pass. The winter storms were very severe, and in the spring the works were frequently flooded as a result of the melting of the snow and ice. On the other hand, in the height of summer the heat was often intense. Apart from these troubles, the tunnellers met stretches of rotten rock or crumbling shale that made necessary a great amount of timbering and subsequent lining.

Boring was conducted from both ends of the tunnel simultaneously by means of air-drills, and electrical power was obtained by making use of waterfalls at each end of the tunnel. In 1912, when nearly three miles of the tunnel had been bored, the contractors who had undertaken the job asked to be relieved of their contract. From 1913, therefore, the Government took over the workings in view of the national importance of the undertaking. The War hampered the progress of the tunnel, but the work was continued, and the rock barrier was finally pierced on 20th July, 1918, when the drillers on either side met.

The tunnel drops 850 ft. from the Eastern to the Western end, and is on a falling gradient of 1 in 33. It is of horse-shoe section, 17 ft. in height by 15 ft. in width, and is lined throughout with concrete blocks. As it runs dead straight, it is just possible when standing at one end to see through it. Altogether the Tunnel cost £1,500,000, and necessitated the excavation of 314,816 cu. yds. of rock and 10,700 cu. yds. of earth.

The electric locomotives used for the passage of the Tunnel were built by the English Electric Co. Ltd., and these can haul a load of 140 tons up the steepest gradient. Current for the overhead wires is obtained from a 4,000 H.P. generating station situated at Otira.

We leave Arthur's Pass at 1.42 p.m., and after a severe up-grade of about a quarter of a mile up to the tunnel mouth enter the tunnel with a roaring sound. After a run of 22 minutes through the electrically illuminated bore, we reach Otira at 2.4 p.m., three miles on the other side of the tunnel, in the Otira Gorge. Here we stop for 25 min. for dinner. Locomotives are once again changed from electric to steam, a 4-cylinder compound "Pacific" of the "A" class taking the place of the electric locomotive. These "A" class engines are slightly smaller than the "AB," and together with the 4-8-2 locomotives of the "X" class used in the North Island are the only compound engines in New Zealand.

Leaving Otira at 2.29 p.m., we have a fast run downhill through the hills of the West Coast, which are thickly covered with bush. Stillwater Junction, 42 miles from Otira, is reached at 3.57 p.m., where connection is made with the Reefton branch, which serves a coal, timber, farming and gold district. Stillwater is left at 4.2 p.m., and the last lap of the journey to Greymouth is covered at a very low speed, owing to the extremely tortuous nature of the line. We finally reach Greymouth at 4.29 p.m.

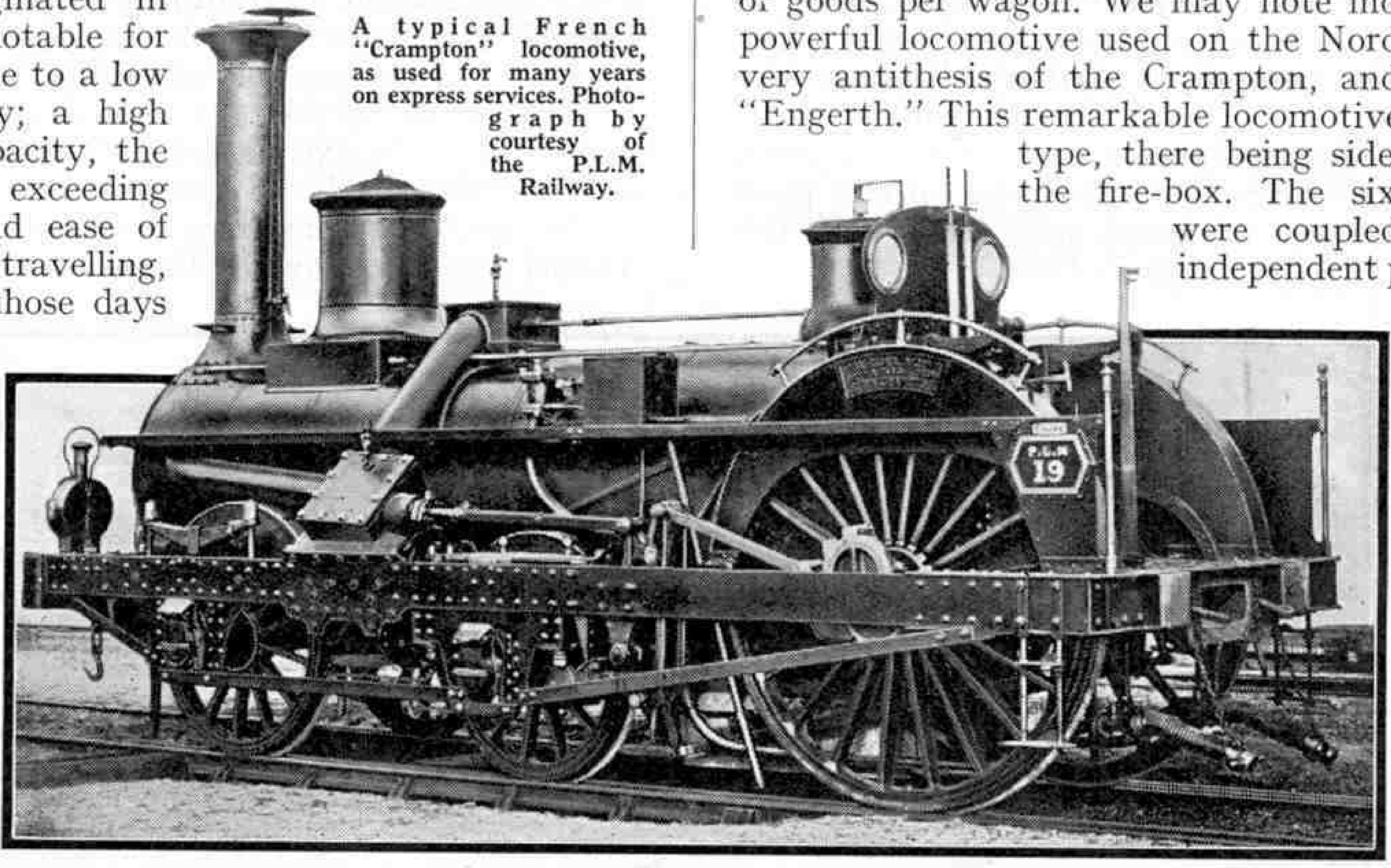
Early Continental Locomotive Types

Features of some Old Designs

By R. D. Gauld, M.Eng., A.M.Inst.C.E.

IN an old French book giving a general survey of railway engineering, and written by M. Amedie Guillemin, interesting particulars are given of some of the earliest locomotives in France. Some of these are fairly well known, but others are mentioned which we do not recollect having seen described elsewhere.

The book was apparently written in the 1850s, at which time all locomotives for passenger work had single driving wheels, whose diameter varied from 5 ft. 6 in. to 7 ft. 6 in. Of these the most outstanding type was the Crampton, which worked the express train services on the Est, the Lyon (afterwards the P.L.M.) and the Nord systems. It originated in 1849, and was notable for great stability due to a low centre of gravity; a high steam-raising capacity, the heating surface exceeding 1,070 sq. ft.; and ease of attention while travelling, so necessary in those days of primitive lubrication.



A typical French "Crampton" locomotive, as used for many years on express services. Photograph by courtesy of the P.L.M. Railway.

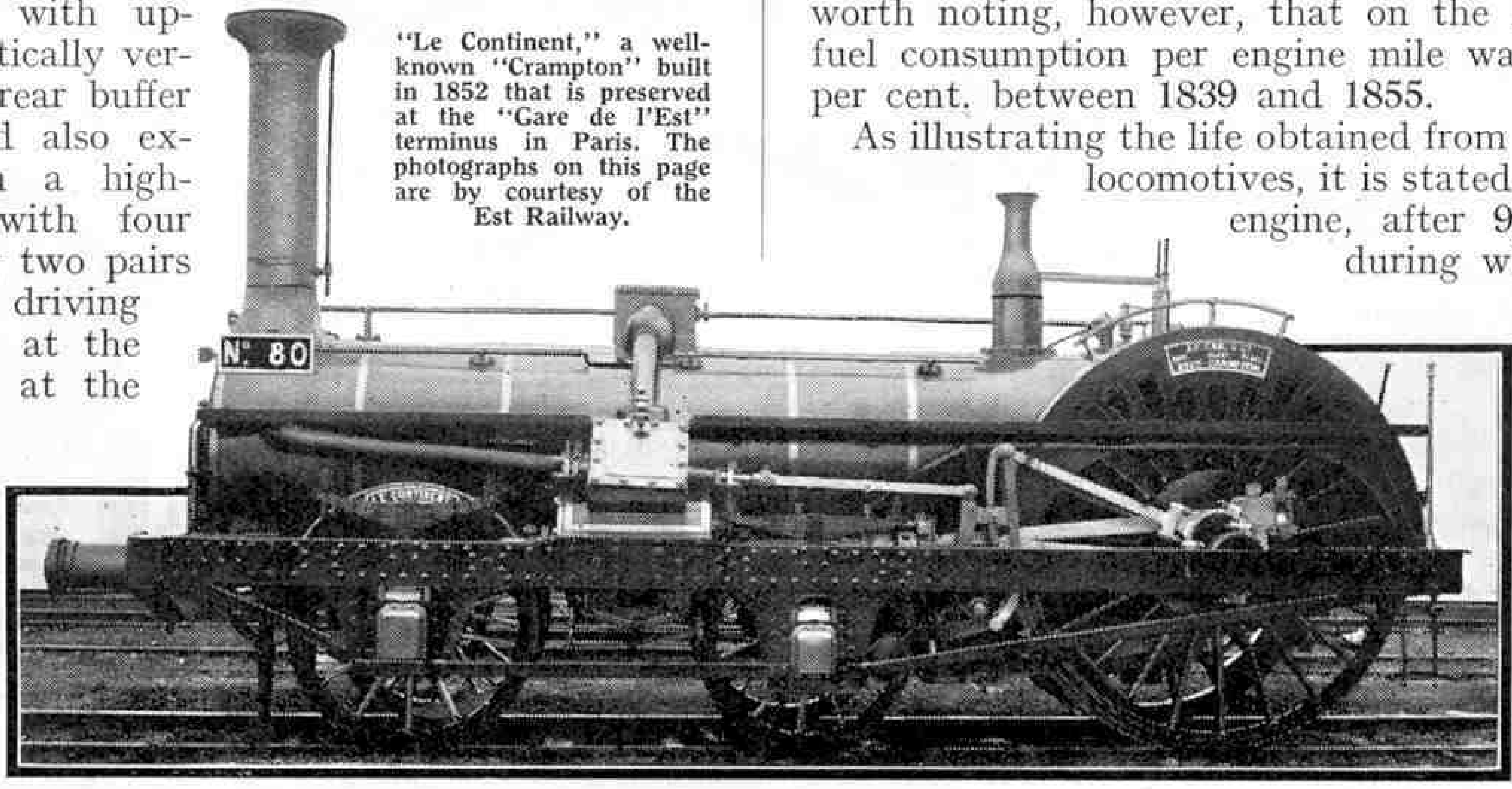
The driving wheels were placed at the rear, so that their axle was behind the fire-box. The other two pairs of wheels, whose diameters were not equal, were placed one about the middle of the boiler barrel and the other a little behind the smoke-box. The fire-box and steam space were unusually large so that a very small dome sufficed. The horizontal cylinders were placed inside the frames, which were outside; while the valves were inclined both to the horizontal and the vertical. The steam pipes came out from each side of the small dome containing the regulator valve, bent down round the boiler to the valve chests; while the exhaust pipes, at right angles to the steam pipes, extended from the ends of the steam chests, along the boiler, into the smoke-box. The feed pumps were behind the cylinders.

Although the Cramptons were such successful engines, other satisfactory types were in use in France before 1860. There were the Buddicom engines, working passenger trains on the Paris to Rouen line, and the Polonceau engines for express train services on the Orleans line, both of which were speedy and simply designed engines. In both types the driving wheels were placed between the others, that is to say, they carried the middle of the boiler. The cylinders were outside, and were inclined in the Buddicom locomotive and horizontal in the Polonceau engine. The latter arrangement reduced the galloping movement so liable to occur with inclined cylinders. While the engines of the Ouest line retained the steam dome, those of the Orleans line, like the Cramptons, had practically none. Both these types had the speed capacity of the Crampton engines, but only four-fifths of their power.

Turning now to goods engines, the diameter of the driving wheels at that time ranged between 3 ft. 7 in. and 4 ft. 11 in. The speed did not usually exceed 20 miles per hour, but loads were hauled on lines with gradients not exceeding 1 in 200, up to 45 wagons loaded with 10 tons of goods per wagon. We may note more particularly a powerful locomotive used on the Nord, which was the very antithesis of the Crampton, and was called the "Engerth." This remarkable locomotive was of the tank type, there being side tanks adjoining the fire-box. The six leading wheels were coupled, there was an independent pair of wheels just in front of the fire-box, and two separate axles carried the rear water tank and coal bunker. For those days the heating surface was very considerable, not only on account of the great length of boiler, and hence of tubes, but also because of the large fire-box. The two horizontal outside cylinders were placed in front of the leading wheels, and had a straight exhaust into the smoke-box. The steam collecting box was just behind the chimney, the regulator rod being carried above the boiler.

A third type of locomotive is to be considered, the mixed traffic engine, intended for medium speeds, and sometimes drawing heavy passenger trains, sometimes goods trains, sometimes mixed trains partly of passenger vehicles and partly goods wagons. The speed in those days would be between 22 and 32 miles per hour, according to gradient and load, the latter being usually 20 to 24 vehicles. Their driving wheels had a diameter intermediate between those of the two types already mentioned, usually 4 ft. 10 in. to 5 ft. 3 in. Usually they had three pairs of wheels, of which two were coupled; and the piston travel had a value lying between those of the fast passenger and the goods engine. A typical engine of the class was that constructed for the Orleans railway by M. Camille Polonceau.

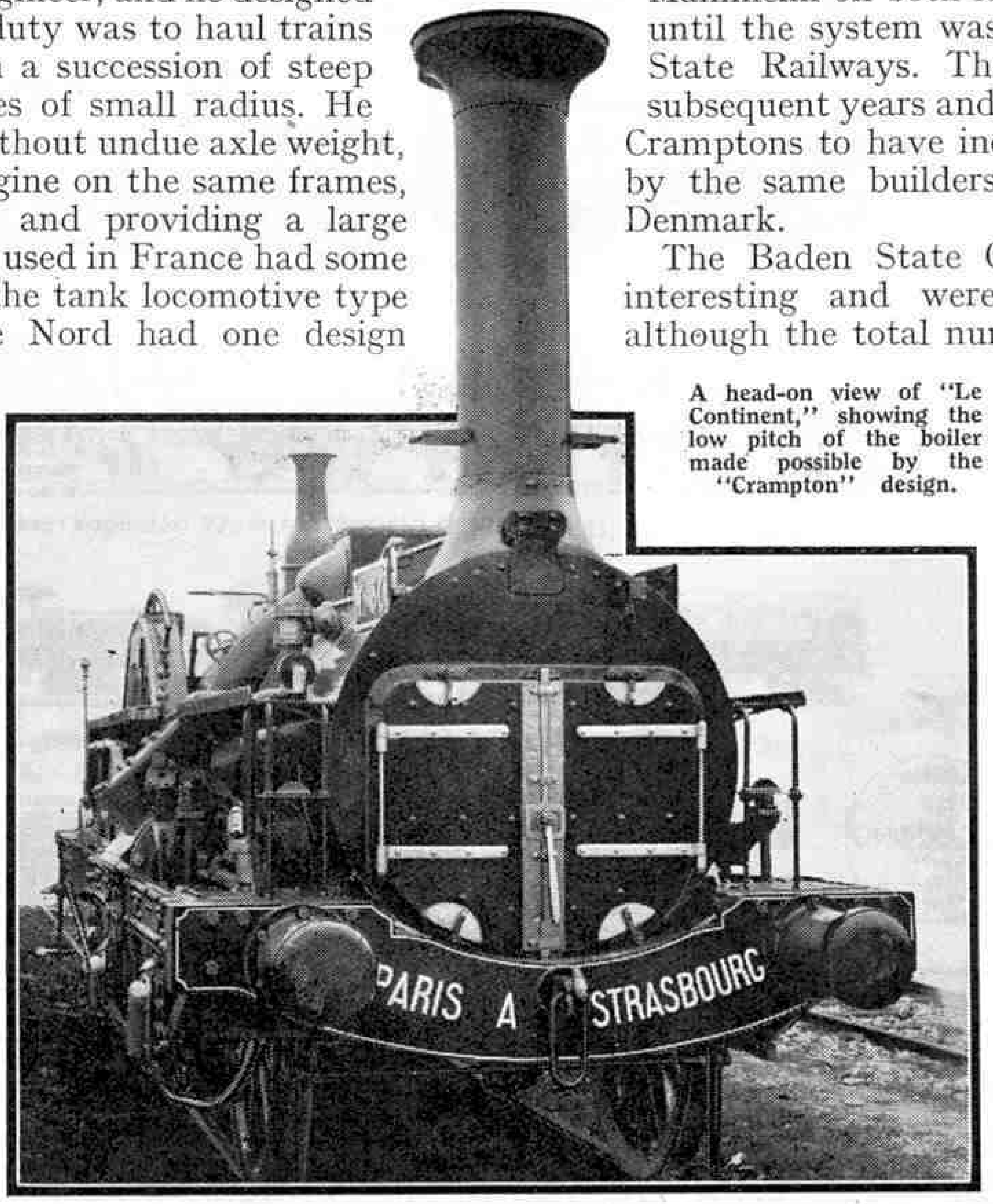
The Nord Railway had in use a goods engine with four cylinders and 12 wheels. The wheels were coupled in two groups of six each, the cylinders being outside and at the extreme ends of the frames. Water and coal were carried on the same frame as the rest of the engine. A peculiar feature was that the flue gases were turned back along the top of the boiler, inside the casing, and discharged by a horizontal pipe with upturned end, practically vertically over the rear buffer beam. The Nord also experimented with a high-speed engine, with four cylinders, having two pairs of large diameter driving wheels, one pair at the front, the other at the rear.



"Le Continent," a well-known "Crampton" built in 1852 that is preserved at the "Gare de l'Est" terminus in Paris. The photographs on this page are by courtesy of the Est Railway.

This old book emphasises the danger incurred by the use of locomotives having only two axles. If one of these broke, as did actually happen on 8th May 1842, the engine tipped up with the other axle as an axis, causing disaster to the train. It is possible that this may have indicated the advisability of a third axle, not necessarily coupled, apart from considerations of adhesion.

Engerth was an Austrian engineer, and he designed and built locomotives whose duty was to haul trains over the Semmering Pass, on a succession of steep gradients connected by curves of small radius. He obtained the desired result, without undue axle weight, by putting the tender and engine on the same frames, using many coupled wheels, and providing a large fire-box. The Engerth engines used in France had some different features, but made the tank locomotive type popular for some time. The Nord had one design having four axles, all coupled, and two cylinders at the front end. As in the Nord goods engine already described, a flue was brought back, and then turned up with a short bend, just above the boiler back plate.



A head-on view of "Le Continent," showing the low pitch of the boiler made possible by the "Crampton" design.

The weights of some of these old engines are interesting in view of modern developments. A typical Crampton locomotive weighed in working order some 27 tons; with its tender loaded with fuel and water the total weight was about 46 tons. The Orleans mixed traffic type of engine weighed just over 20 tons in working order, whereas the Engerth locomotive was twice as heavy. Fuel capacities then were very small, the Crampton's tender holding but 30 cwt., and the amount of coke carried by the mixed traffic engine was just over two tons.

The Crampton locomotive, drawing 12 carriages, consumed 28 lb. of coke per mile in summer, and 30 lb. in winter. The mixed type locomotive, hauling 18 carriages, consumed about the same quantity, while the Engerth goods engine burnt 56 lb. of oil per mile in summer and 63 lb. in winter. These quantities all refer to the best qualities of coke and oil obtainable at that time. It is worth noting, however, that on the Belgian railways, fuel consumption per engine mile was reduced by 58 per cent. between 1839 and 1855.

As illustrating the life obtained from some of these old locomotives, it is stated that a Crampton engine, after 9¾ years' service, during which it ran more than 287,500 miles, still retained most of its original parts. It is startling to find that in those days a yearly mileage of 27,125 was possible. A fair average figure for the life of a locomotive then was 187,500 miles.

In addition to their use in France, Crampton locomotives were widely employed in Germany on the Hesse-Ludwig Railway and on the Baden State Railways. On the former line they worked between Frankfurt and Mannheim on both fast and slow passenger trains, until the system was taken over by the Prussian State Railways. They were built in 1858 and subsequent years and appear to have been the only Cramptons to have inclined cylinders, except some by the same builders for service in Nassau and Denmark.

The Baden State Cramptons were particularly interesting and were of four different classes, although the total number of engines was only 26. The first two engines formed one class and had boilers that were pear-shaped in section. Another peculiarity was that instead of the chimney being located as usual at the front of the engine, it was set back considerably. Actually the smoke-box was doubled back over the boiler barrel, thus leading the products of combustion to the chimney. This arrangement to some extent anticipated the modern extended smoke-box.

The set-back chimney disappeared in the next engines built, although pear-shaped boilers were retained, and bogies were fitted instead of ordinary carrying wheels. One of them named *"Pfeil,"* (*"Arrow"*), was shown at the Paris International Exhibition of 1855. Circular boilers and a rigid wheelbase were reverted later and the final series was built during the years 1860 to 1863. The last member of this class was in service until 1899.

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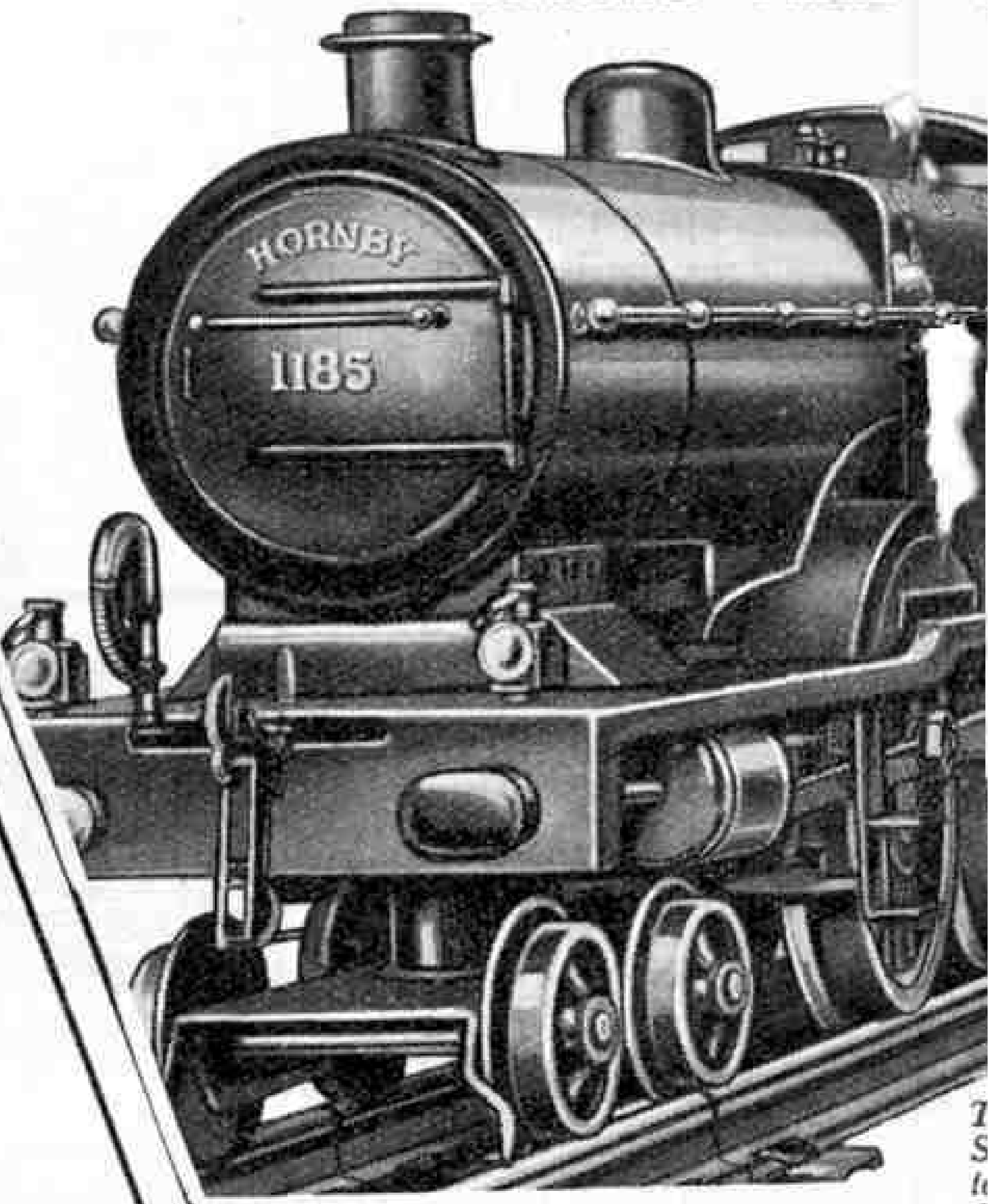
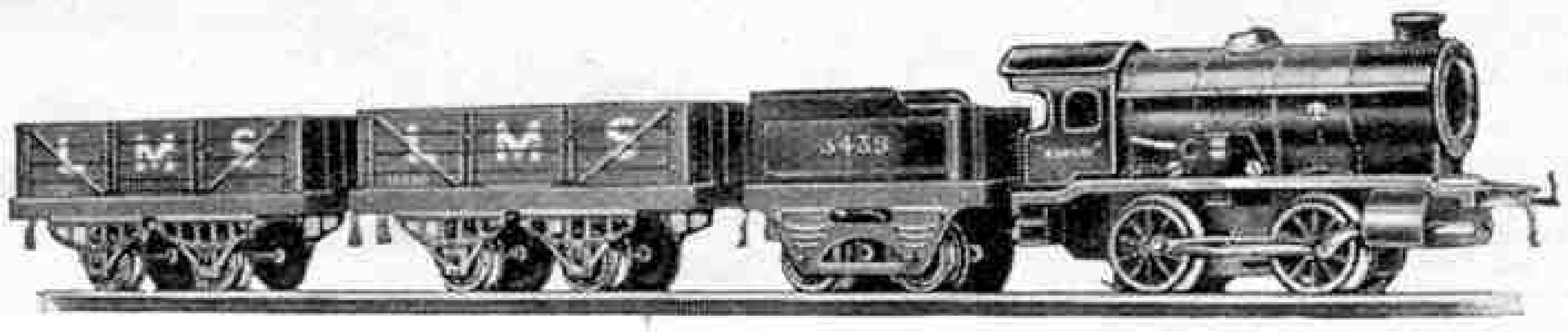


A Selection of HORNBY ELECTRIC TRAIN SETS (20 volt and 6 volt)



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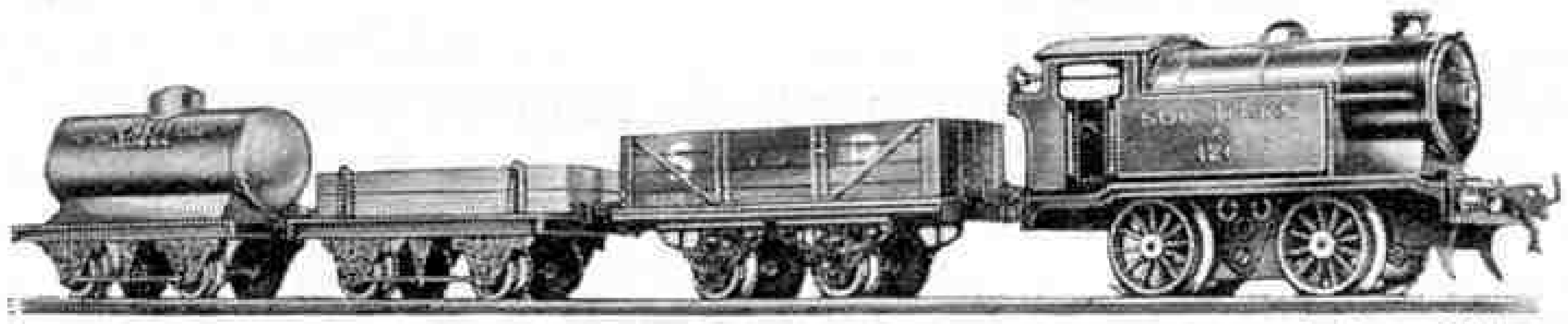

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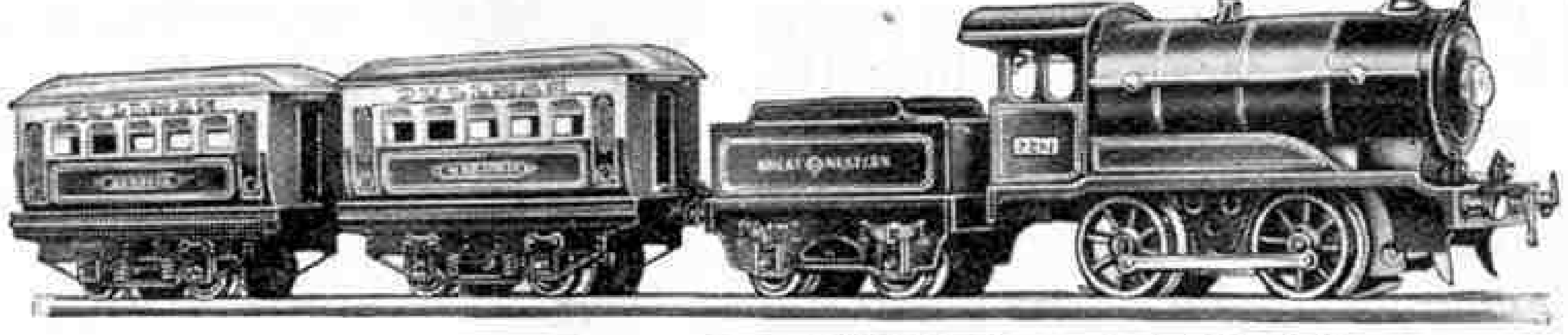

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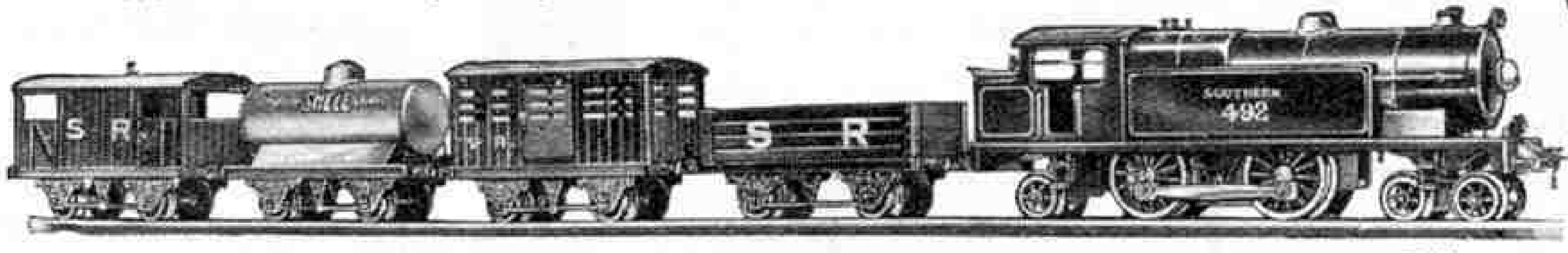
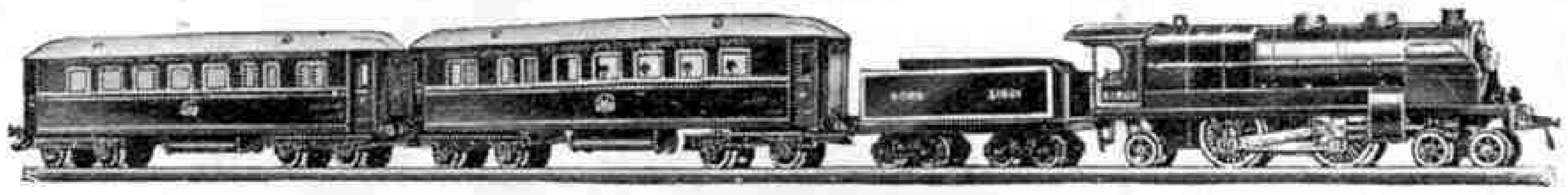


HORNBY No. E220 (20 volt) MIXED GOODS TRAIN SET (automatic reversing). Price **47/6**



HORNBY No. E320 (20 volt) RIVIERA "BLUE" TRAIN SET (automatic reversing). Price **67/6**

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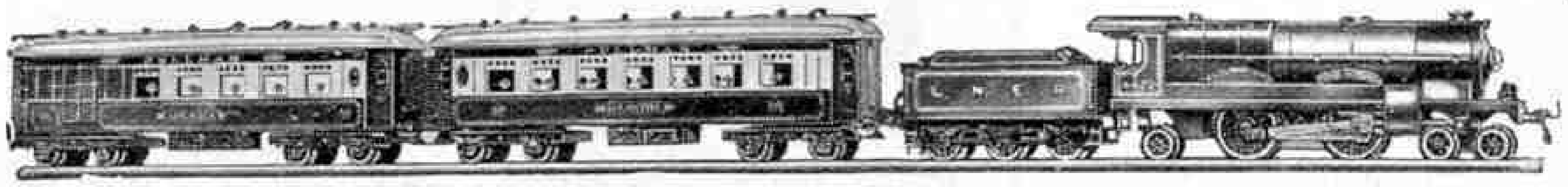

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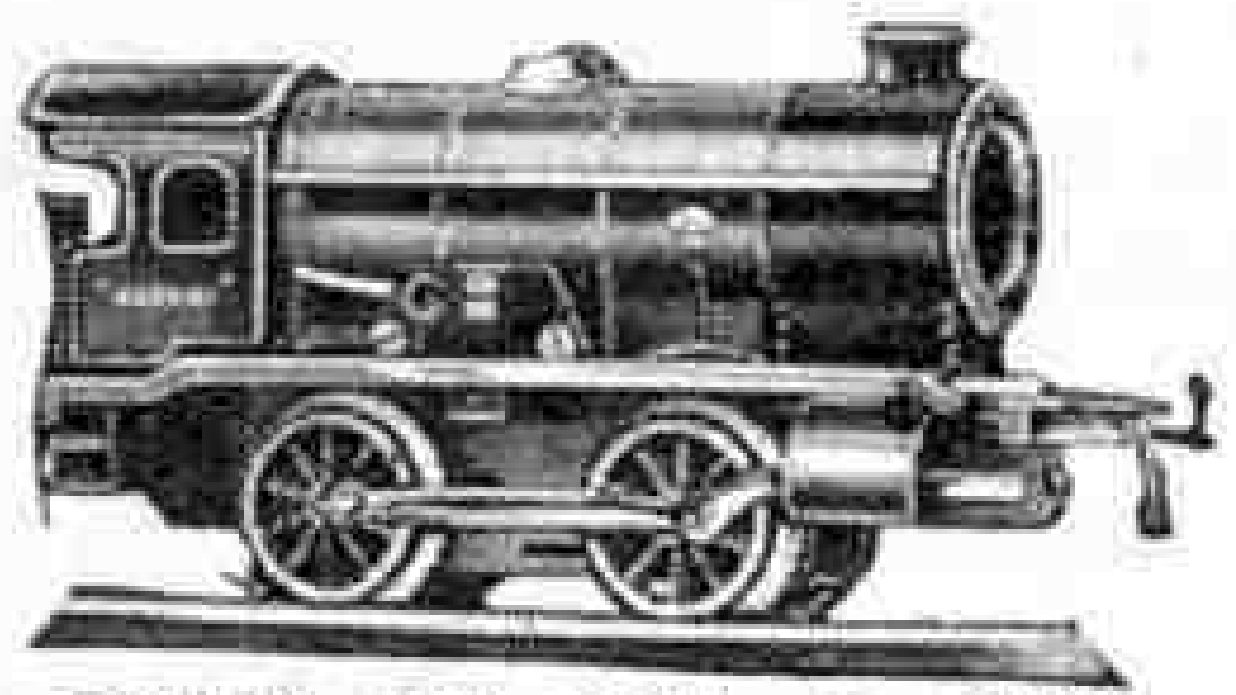
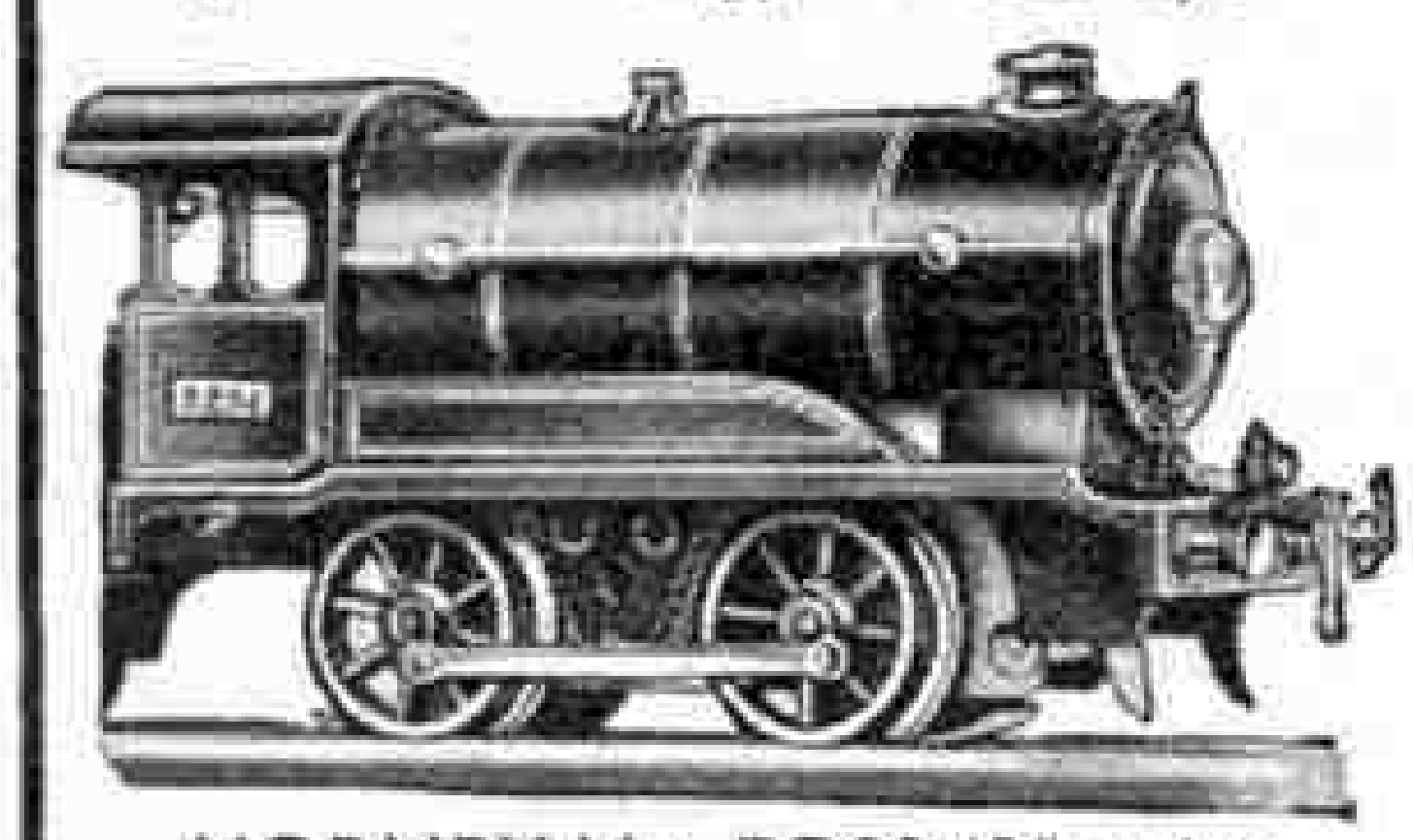
A selection of HORNBY ELECTRIC LOCOMOTIVES (20 volt and 6 volt)



EM120 (20 volt) or EM16 (6 volt) LOCOMOTIVE
(Non-reversing) ... Price **8/6**



HORNBY No. EO20 (20 volt) LOCOMOTIVE
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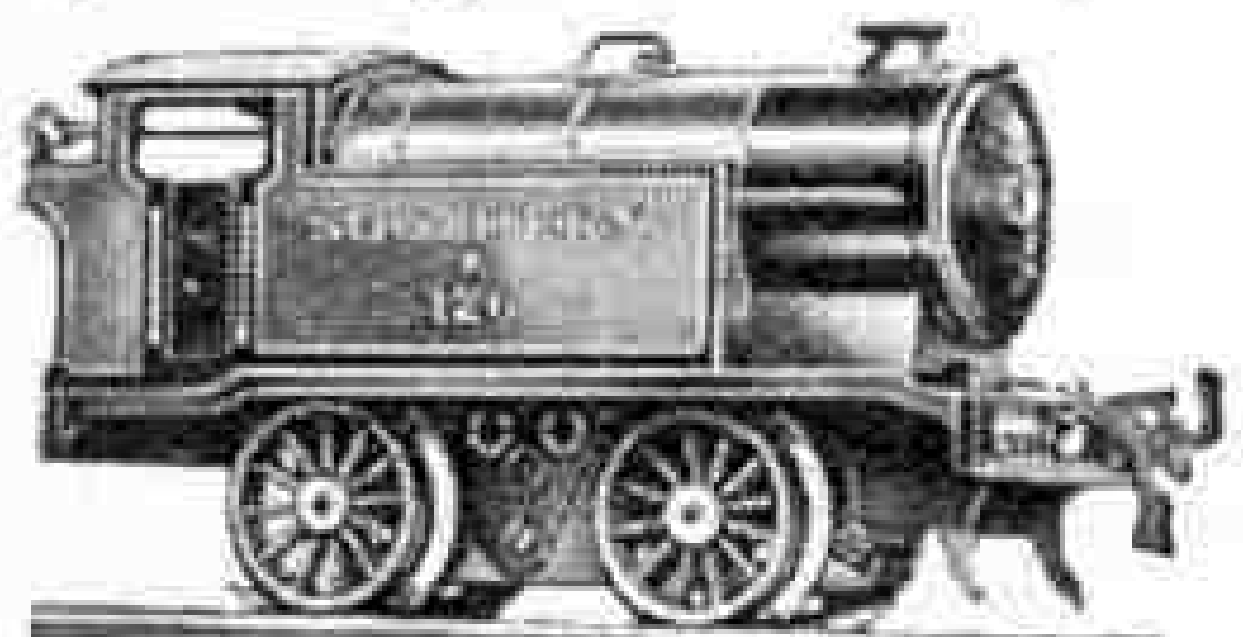
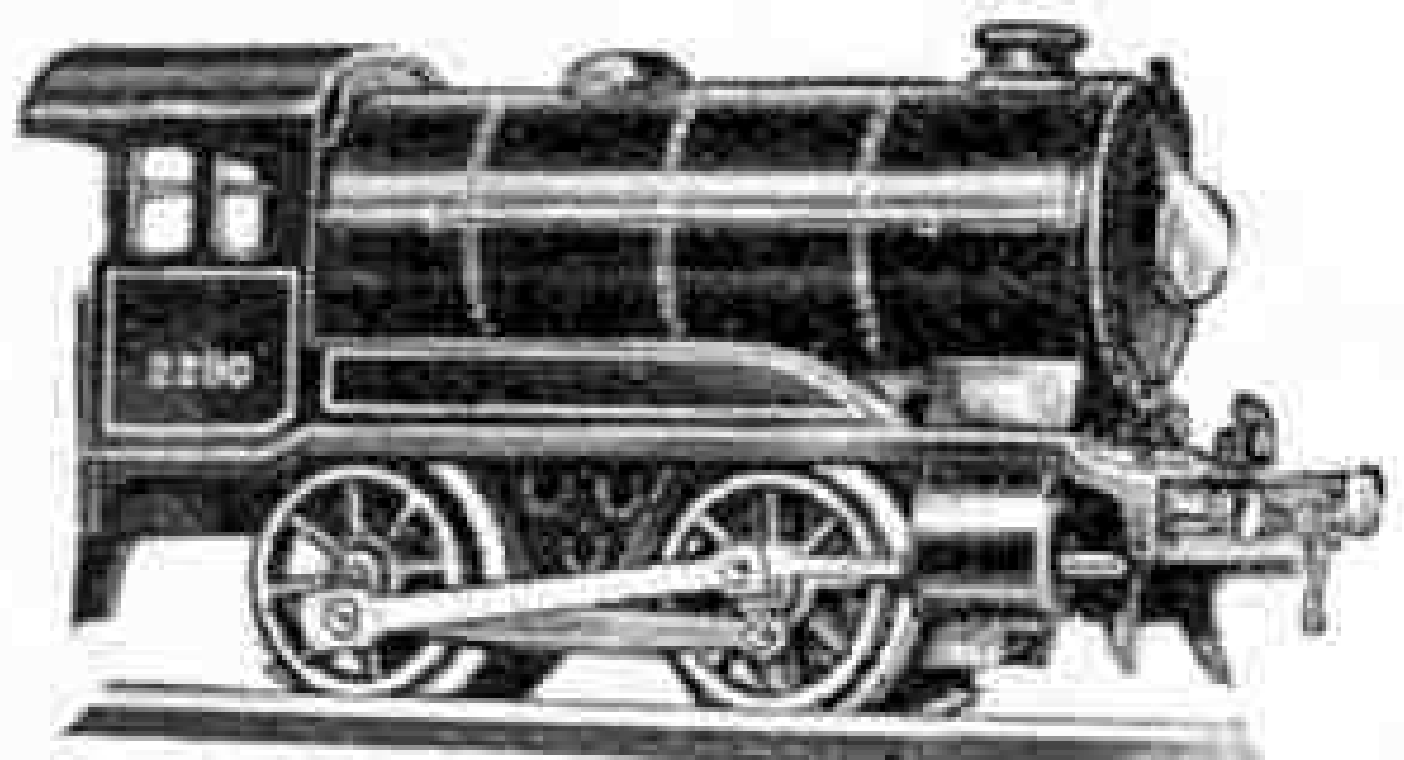


EM320 (20 volt) or EM36 (6 volt) TANK LOCOMOTIVE
(Reversing) ... Price **16/6**



HORNBY No. E120 LOCOMOTIVE (20 volt)
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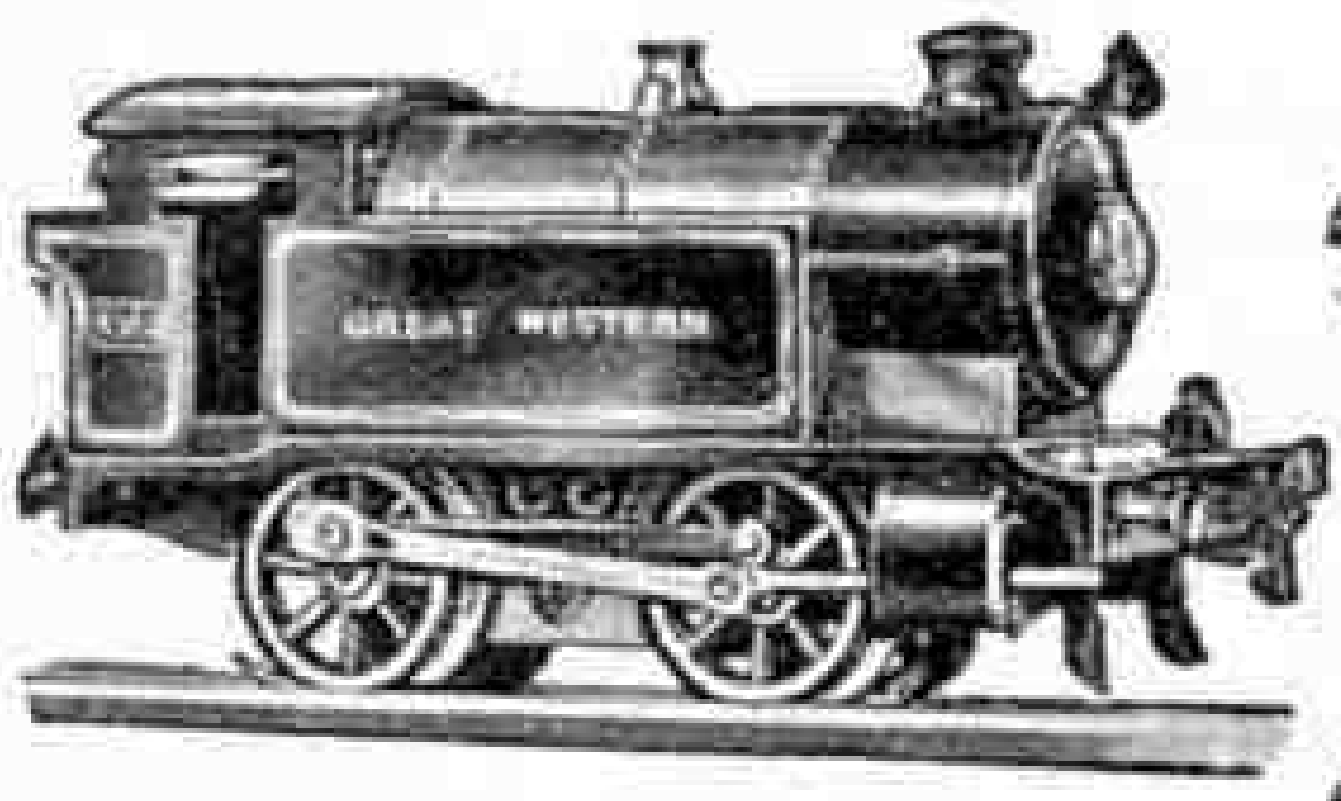

HORNBY No. E120 (20 volt) or E16 (6 volt) TANK LOCOMOTIVE
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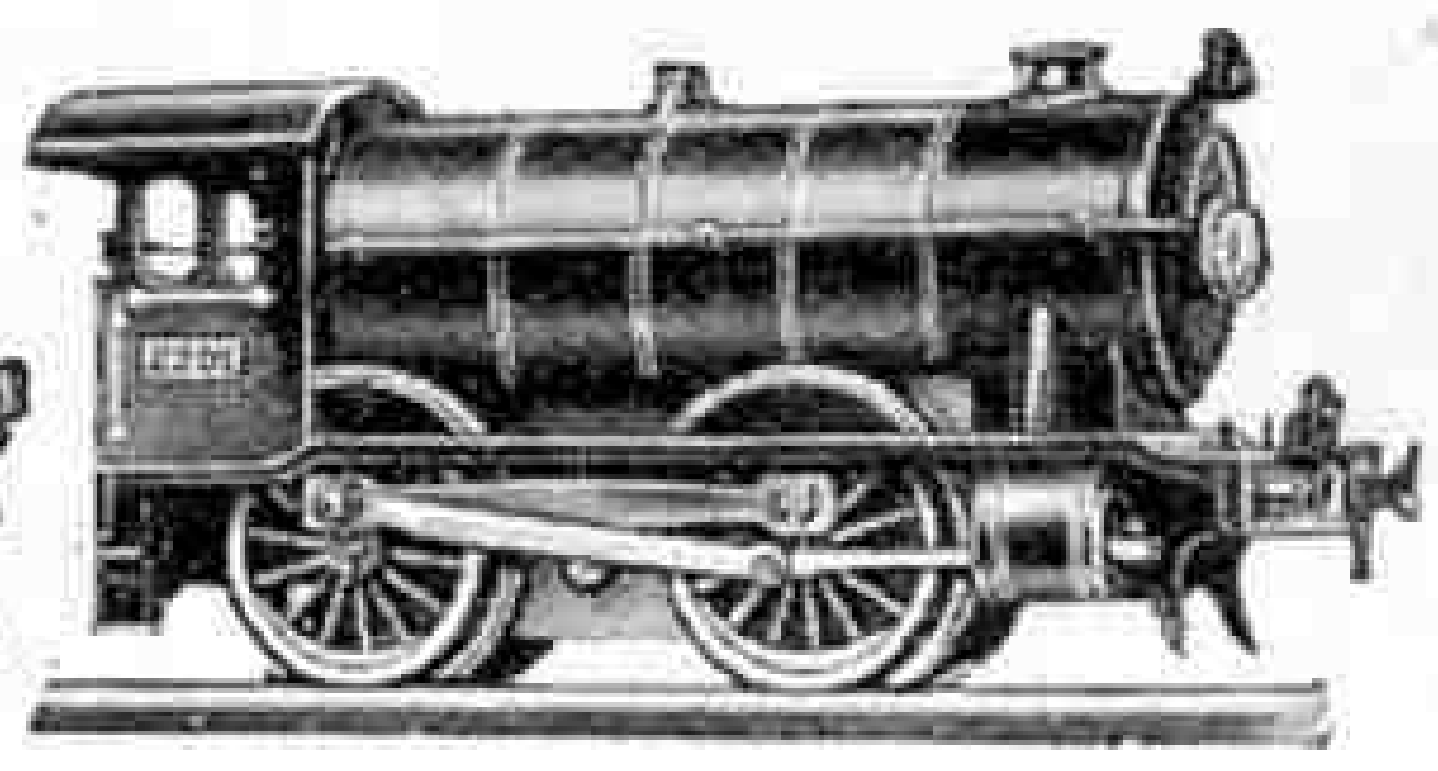

HORNBY No. E120 SPECIA LOCOMOTIVE (20 volt)
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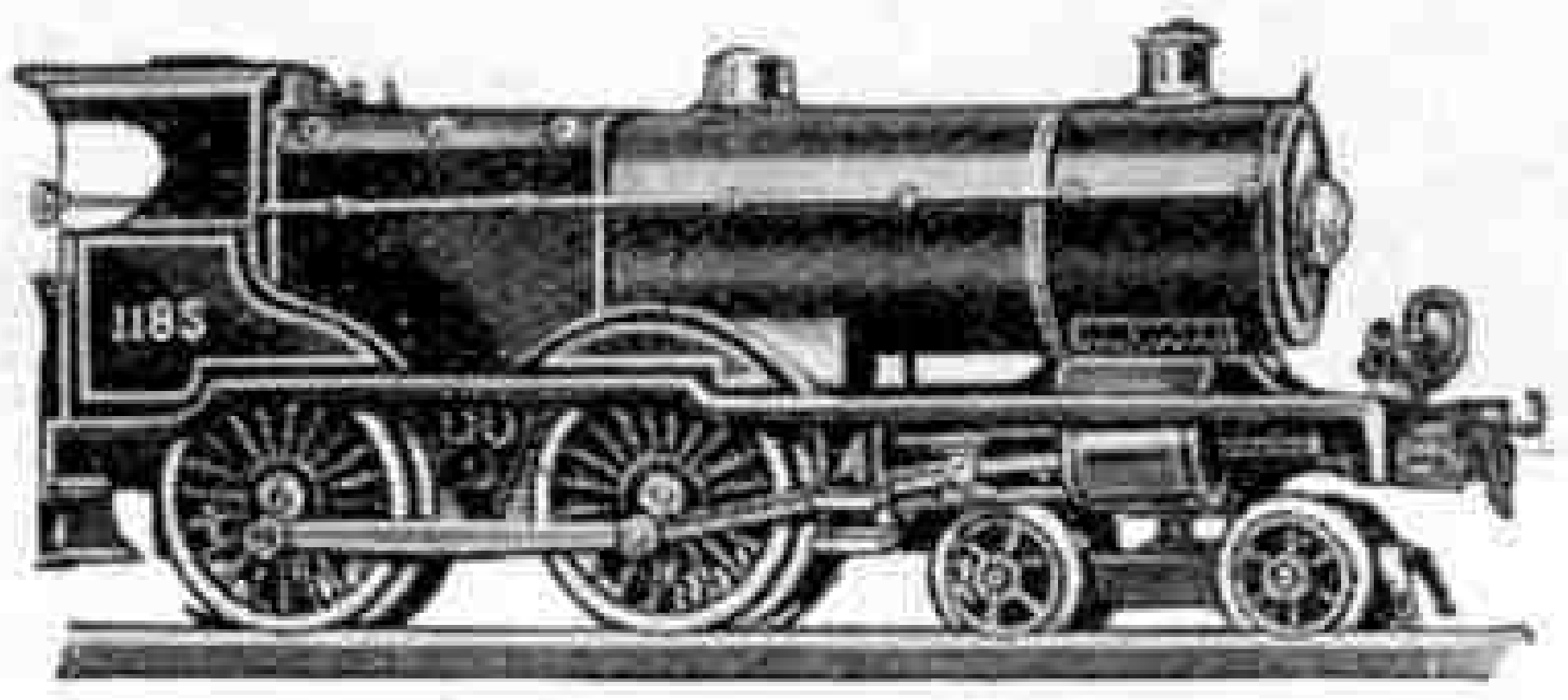

HORNBY No. E220 SPECIAL LOCOMOTIVE
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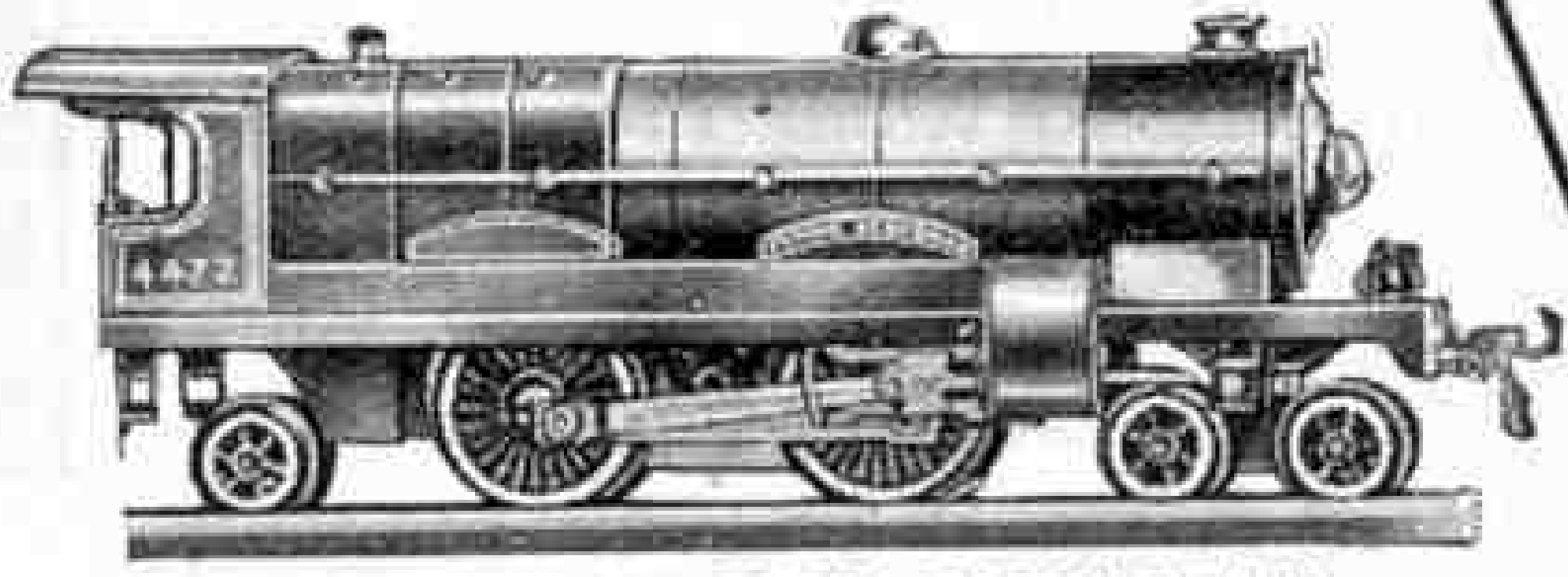

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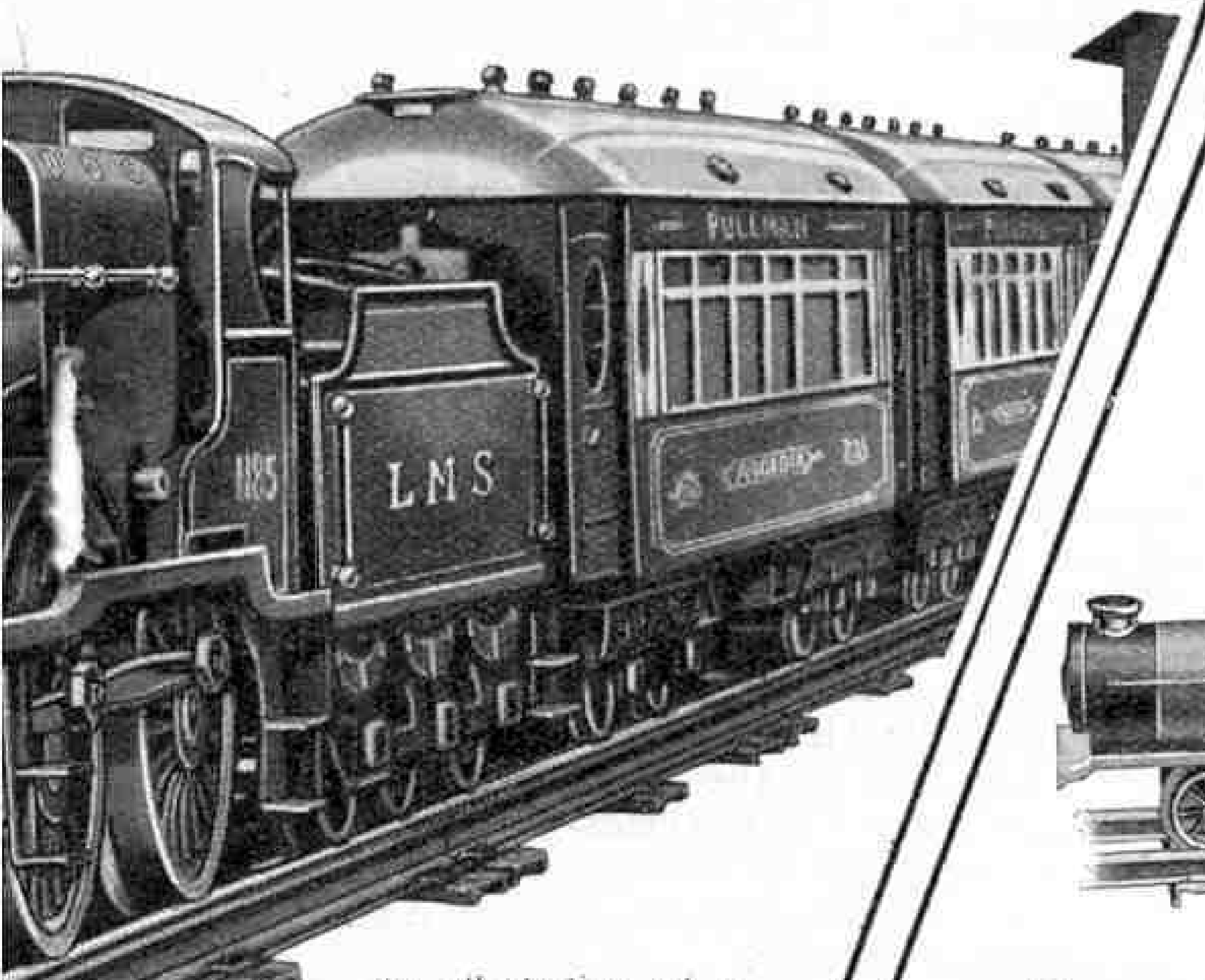

An illustration of a Hornby No. 2 Special Train Set, hauled by a Hornby No. 2 Special Locomotive, the latter a true-to-type model of the real L.M.S.R. Standard Compound Locomotive.

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A Selection of
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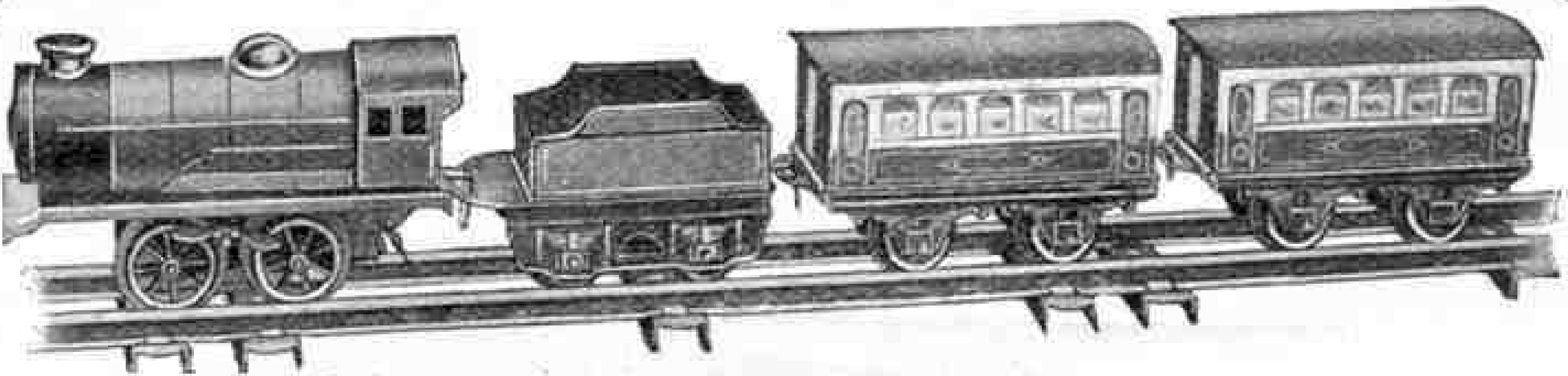
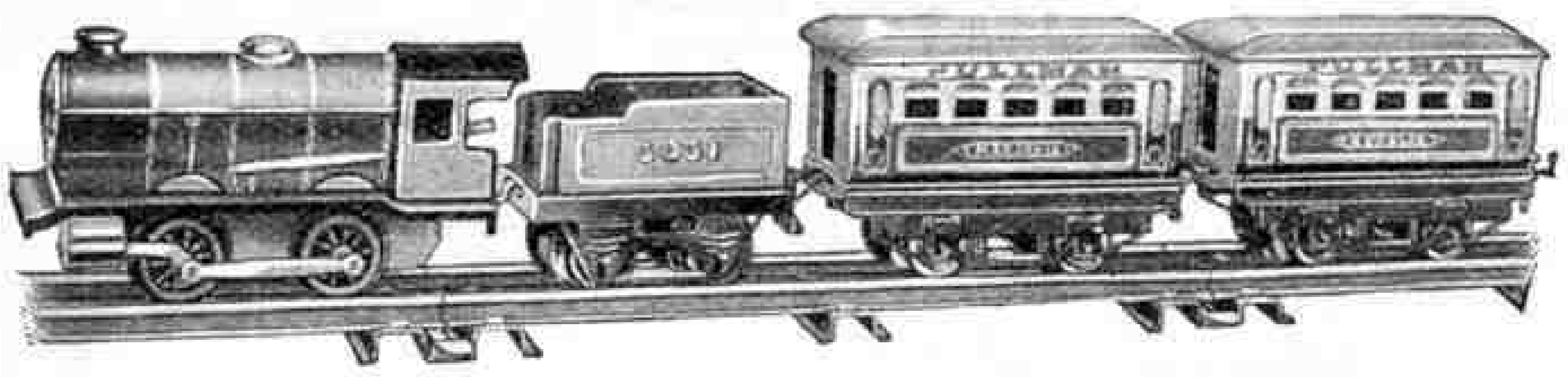


MO PASSENGER TRAIN SET (non-reversing). Price **5/6**



M1 PASSENGER TRAIN SET (reversing). Price **8/11**

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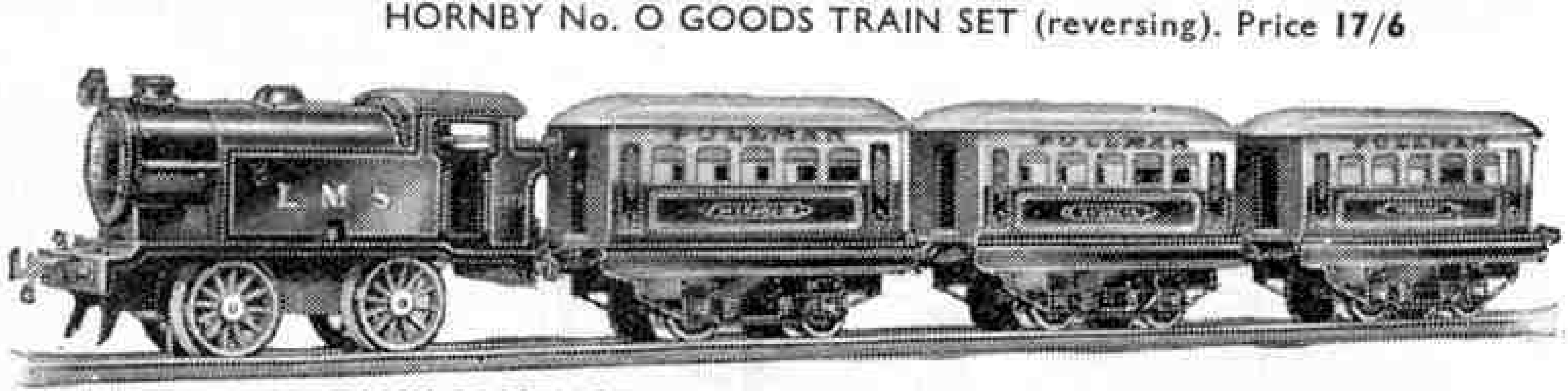
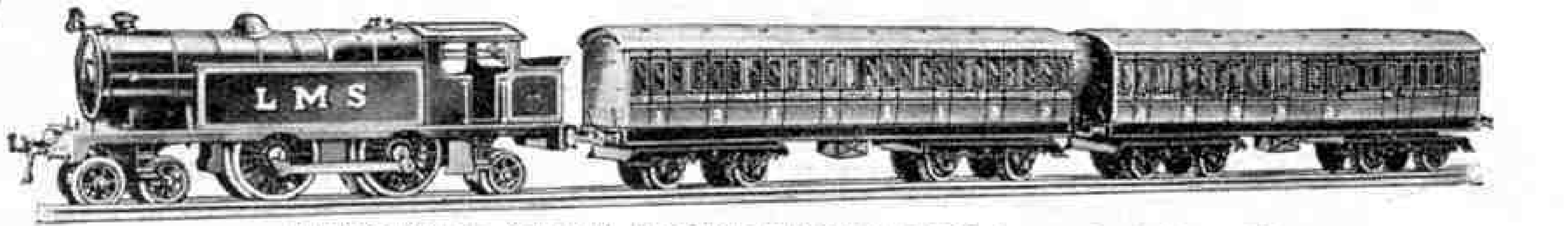


M3 TANK PASSENGER TRAIN SET (reversing). Price **13/9**



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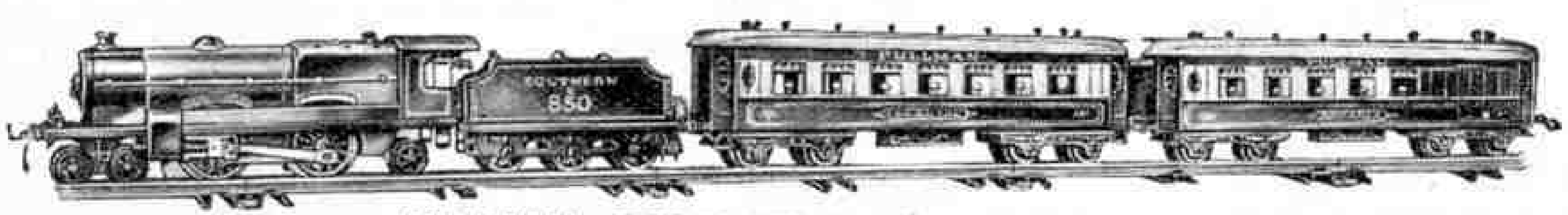

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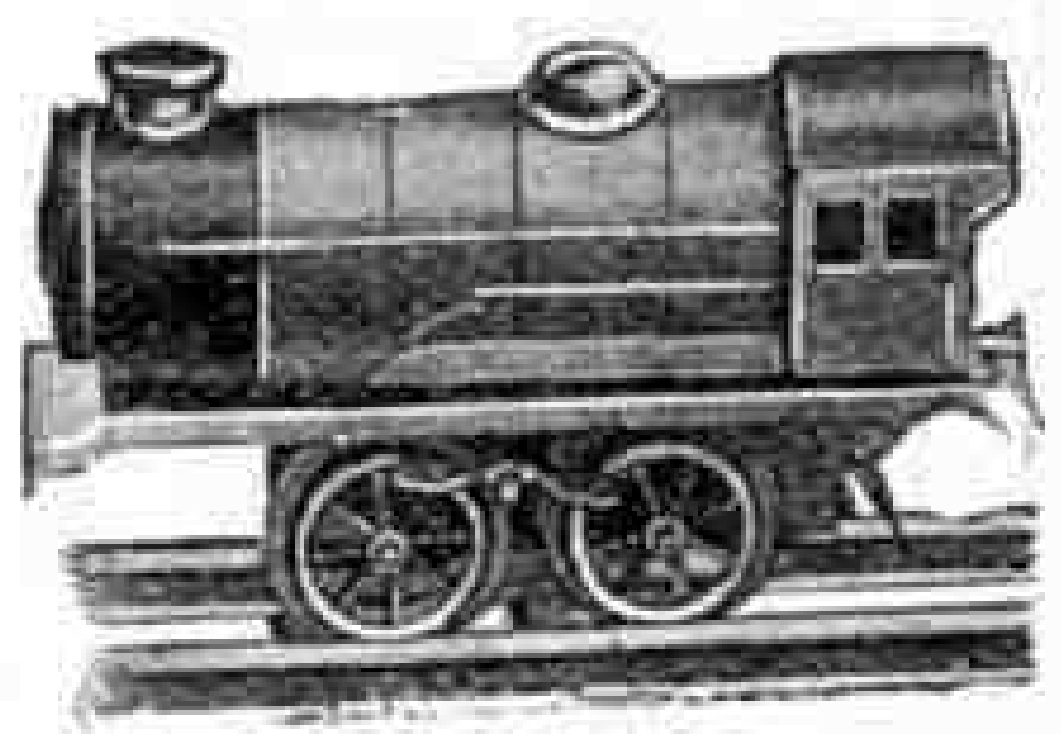
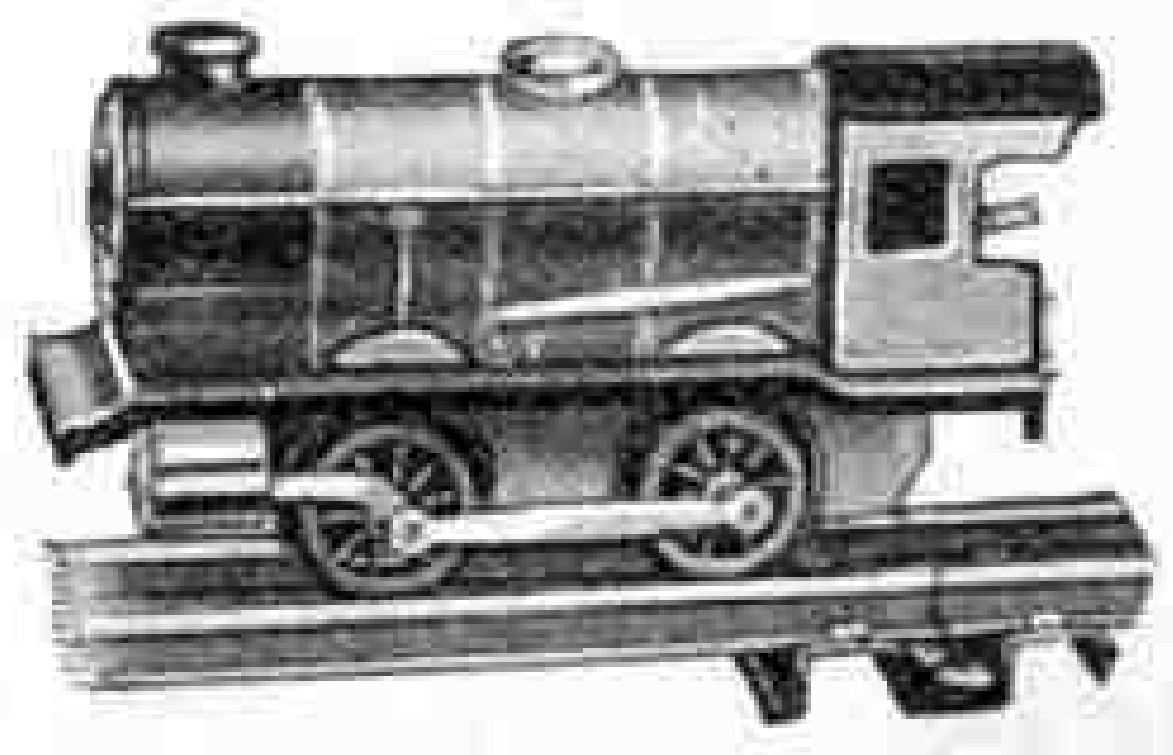


MO LOCOMOTIVE
(Non-reversing) ... Price **2/9**



M1/2 LOCOMOTIVE
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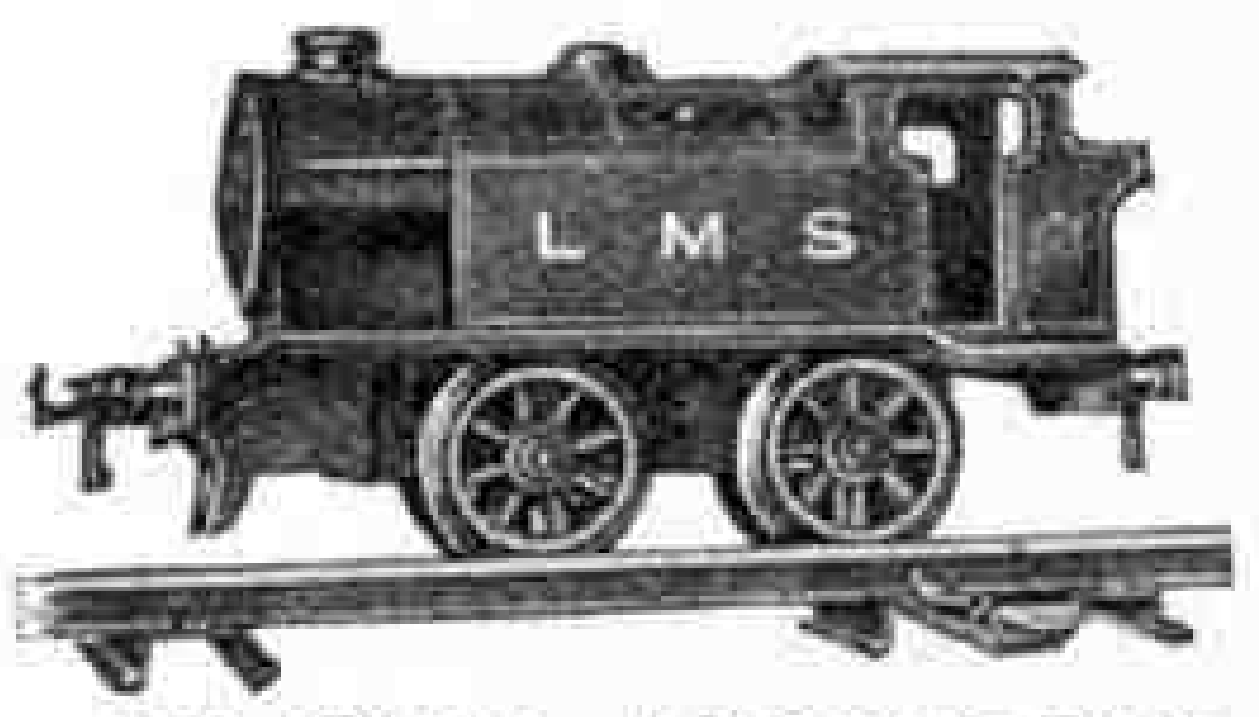

M3 TANK LOCOMOTIVE
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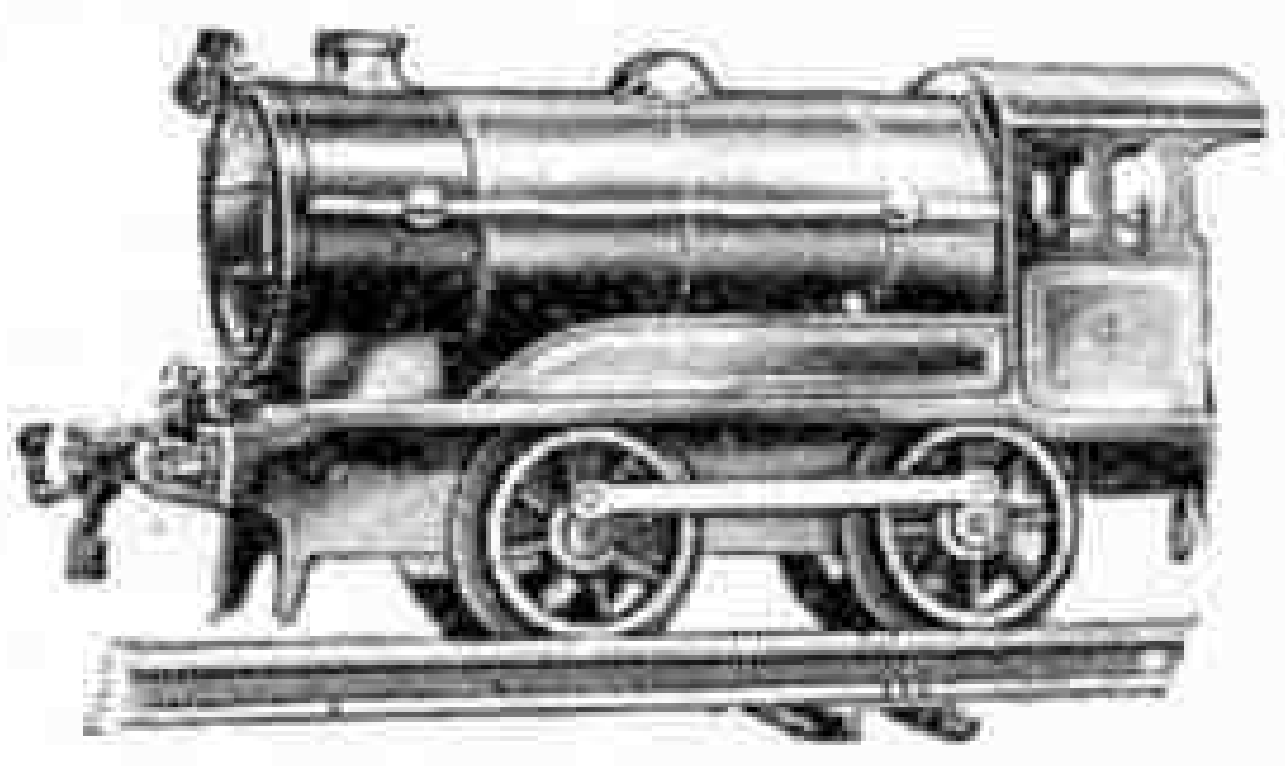

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No. 2 SPECIAL TANK LOCOMOTIVE
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No. 1 SPECIAL LOCOMOTIVE
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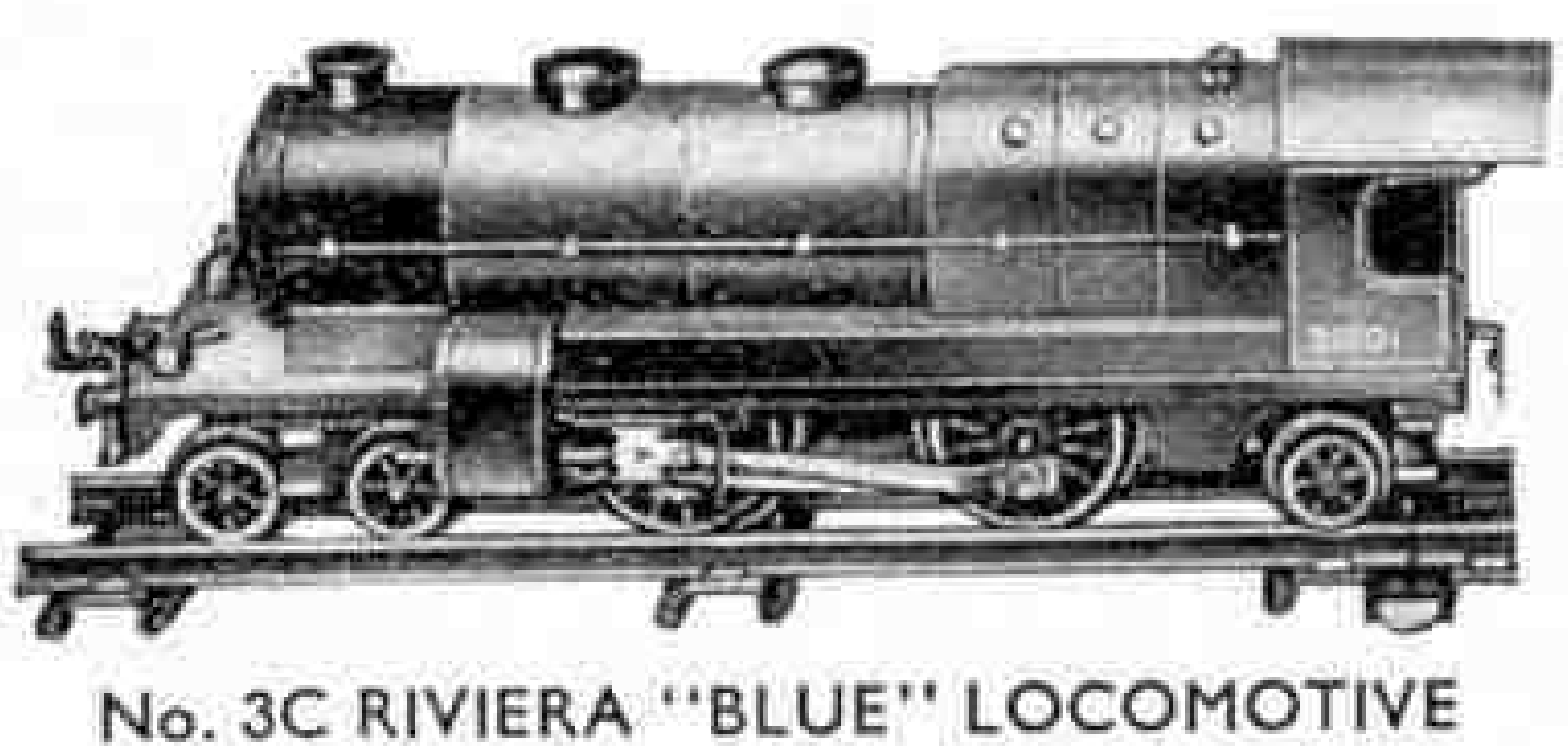

No. 3C RIVIERA "BLUE" LOCOMOTIVE
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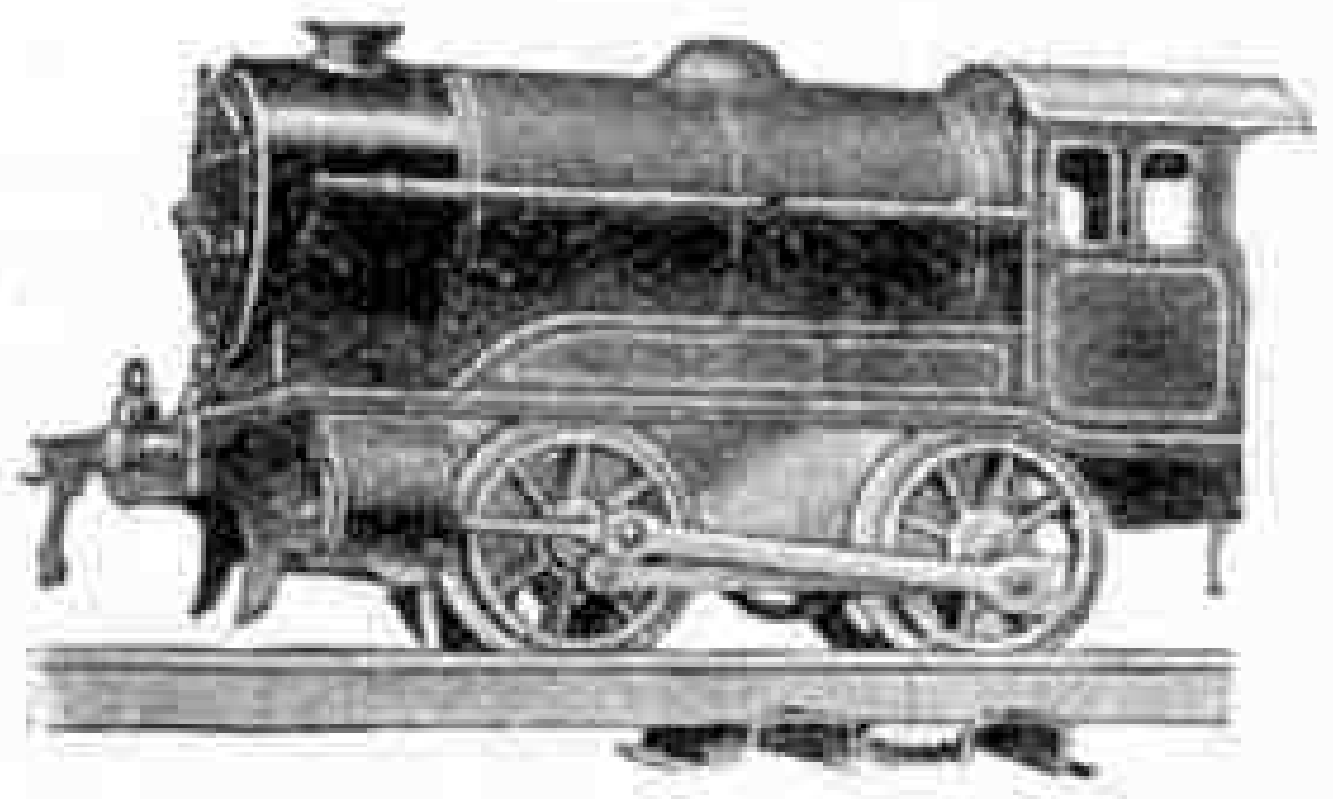

No. 1 LOCOMOTIVE
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INNS ROAD, LIVERPOOL 13.

Railway Bridges

Notes on Familiar Types

By C. H. Hewison (Locomotive Running Department, Walton-on-the-Hill, L.N.E.R.)

THERE are, up and down the lines, numerous features not always observed by those who use the railways, and a little knowledge about some of the constructional works will probably bring new interest to many of our readers in details they have not previously noticed. The bridges are the most important structures on a railway, for without them railways could not exist at all.

The following remarks about bridges are intended to be quite general. No two bridges are ever alike, but it will be found that most bridges more or less follow the principles here laid out.

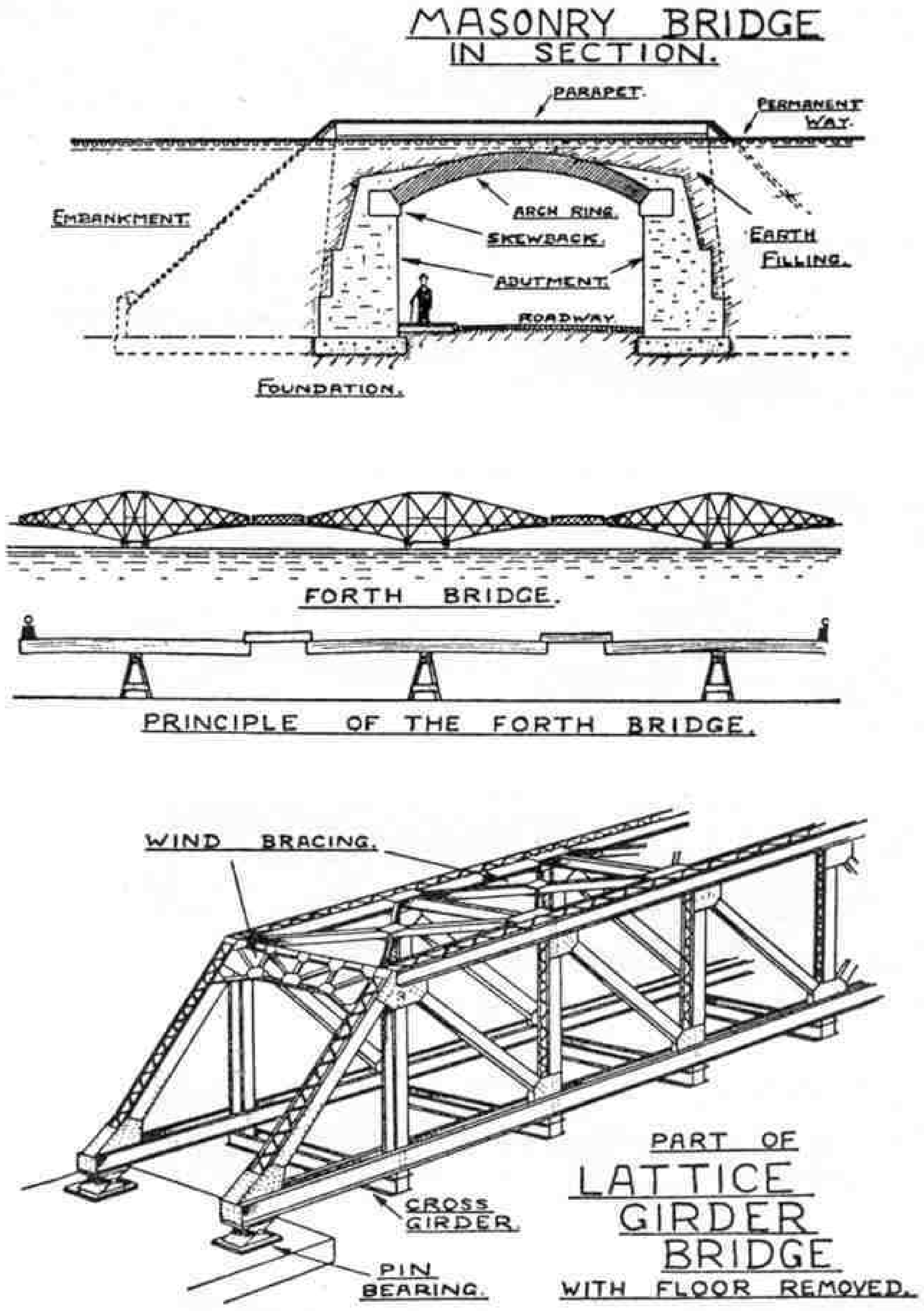


Fig. 1.

All small bridges carrying the railway over minor roads, streams, etc., are usually of the stone arch type (Fig. 1). They are very strong and durable, but stone is an expensive material and the bridge is costly to erect, elaborate temporary staging being required to build the arch on; in these days of economy, therefore, stone bridges are seldom built. Moreover, when the railway crosses a road obliquely, that is, not quite at right angles, a skew arch has to be introduced which, owing to the distances from the centre of the arch to the skewbacks being greater on one side than the other, has the courses of masonry at an angle to, instead of parallel to, them. Each stone for the skew arch has to be very carefully and accurately cut and although brick is sometimes substituted, skew arches are always very expensive.

Modern bridges of moderate size crossing roads, other railways, etc., are usually of the plate girder type. The chief parts of a plate girder bridge, of which a typical example is illustrated (Fig. 2), are the two main girders, built up of steel plates riveted together. The upright centre portion of the girder is called the web and the horizontal parts at the top and bottom of the web are the flanges, secured by rivets to L-shaped steel bars called angles which in turn are riveted to the web.

If a piece of wood about an inch square in section is placed across two bricks, stood on until it breaks and then the fractures examined, it will be noticed that the portion of the material which was uppermost has the appearance of having been crushed, while the lower part will be jagged as if it had been torn apart. What actually takes place in any beam when a load is put on it is that the upper part suffers a compressive force and the lower part is put into tension. Now the purpose of the flanges of a girder is to withstand these forces, and they are made sufficiently thick, being built up with three or four steel plates, so that when the heaviest load the bridge will ever be likely to have to carry is imposed, each square inch of the flanges' sections will not have more than about 5 tons per sq. in. tension or compression. In early days of railways cast iron girders were often used for small bridges, and these have their bottom flanges much bigger than the top ones, because cast iron is very much weaker in tension than in compression. As the bending moment is greatest towards the centre of a girder the flanges are usually made thicker at the middle than at the ends.

The most economical design is obtained by making the girder equal in depth to about one tenth of the span. The web, being usually rather thin in proportion to its height, has to be stiffened to prevent it from buckling or bending over sideways, and this is done by fitting some steel angles or "gusset" plates vertically on the sides, a few feet apart, together with a stout plate at each end of the girder.

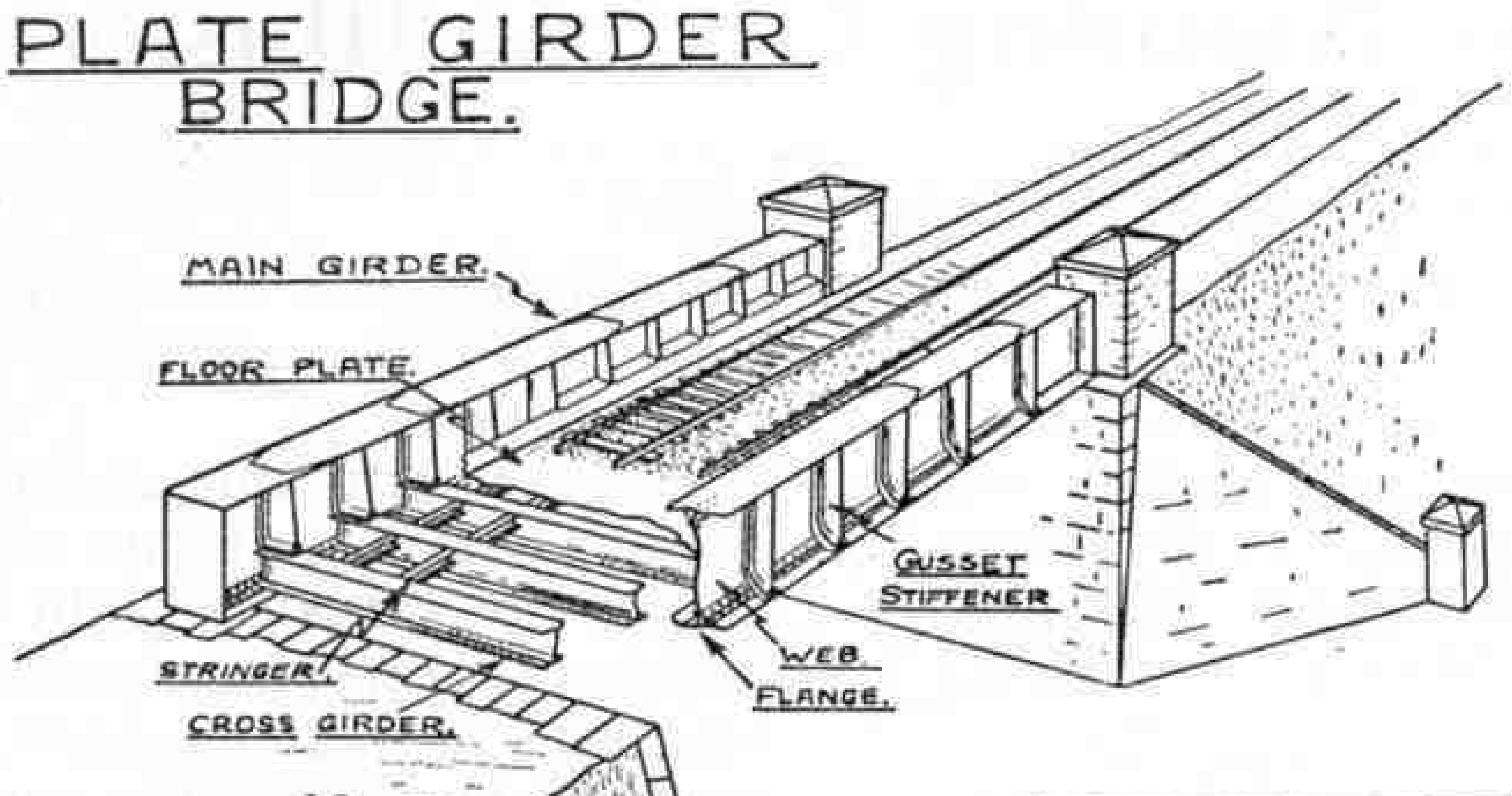
Between the two main girders of the bridge are stretched the cross girders, fastened with angles to the main girders' webs and resting on the inner edges of their bottom flanges. They are usually spaced about 6 ft. apart. Between the cross girders are placed the railbearers or stringers, so spaced as to be directly under the rails of the permanent way; they are usually secured so that their upper flanges may be level with the tops of the cross-girders, permitting plates to be laid on the framework thus formed. This floor is covered with a bed of asphalt about an inch and a half thick over which the ballast is spread and the permanent way laid in the usual way. As an alternative to the cross-girder system, trough floors are sometimes laid, especially in bridges carrying a single line of railway.

Plate girders are rarely used for bridges beyond a hundred feet span owing to the excessive weight and amount of material required. For larger bridges over rivers or very wide streets lattice girders are introduced. A large variety of types of lattice girder bridges exists, constructed to all sizes; one of the largest in the British Isles is on the L.N.E.R. main line at Newark, over the River Trent. The chief types of lattice girder are illustrated (Figs. 1 and 2), and in modern bridge construction of moderate size, the N-girder and the Warren girder are probably the most used. The general principle of the bridge is the same as the plate girder type; two main girders carrying cross-girders which in turn support the floor and the track. As a rule the cross-girders are level with the bottom of the main girders, but, where levels permit, they are sometimes carried on the top, forming a "deck" bridge, a better form of construction which can be made much stiffer and is less affected by wind pressure. The lattice girder consists of an upper and lower boom to take the compressive and tensile stresses respectively, and these are kept in position by ties and struts instead of a web. A tie, it should be explained, is a member in tension while struts are designed to resist compression. In an ordinary N or Linville girder which may have sloping or vertical ends, the vertical members are always in compression and the sloping members, except the end ones, if sloping ends are included, are in tension. This is true when the load is centrally imposed, but on a bridge the load may be anywhere and when near one end the centre sloping members are liable to be put into compression; as they are not designed for this, two more ties sloping in the opposite direction are included to provide for uneven loading.

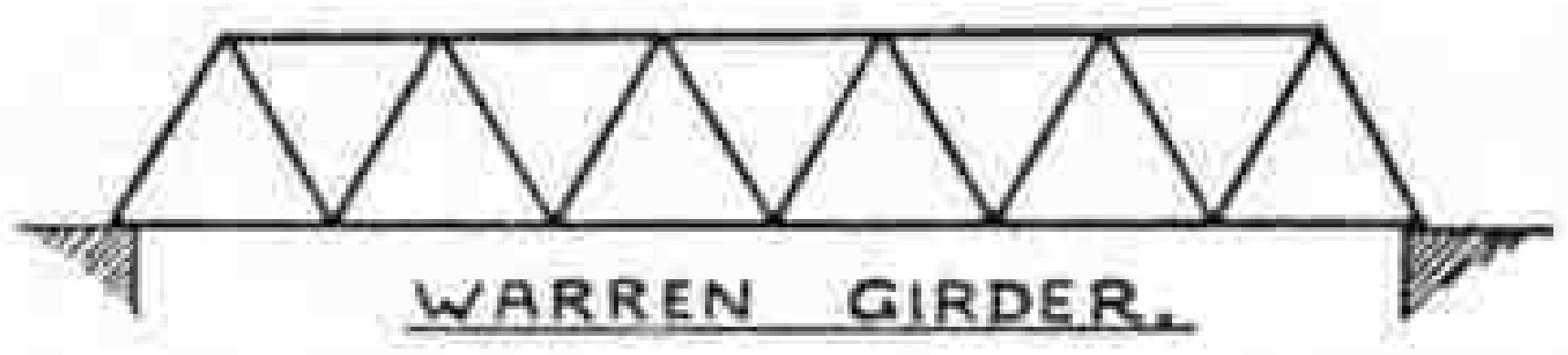
For all sorts of steel constructional work, not only bridges, but steel frames for buildings, big roofs, electric cable pylons and a hundred other structures, standardised commercial sections, of which the principal are the I-beam, or joist, the channel or U-section, the angle or L-section, and the tee, are available. These sections are made in lengths to a variety of sizes laid down by the British Engineering Standards Committee and are of mild steel. Flat bars are also available and these sections are used together with plates for every form of steelwork.

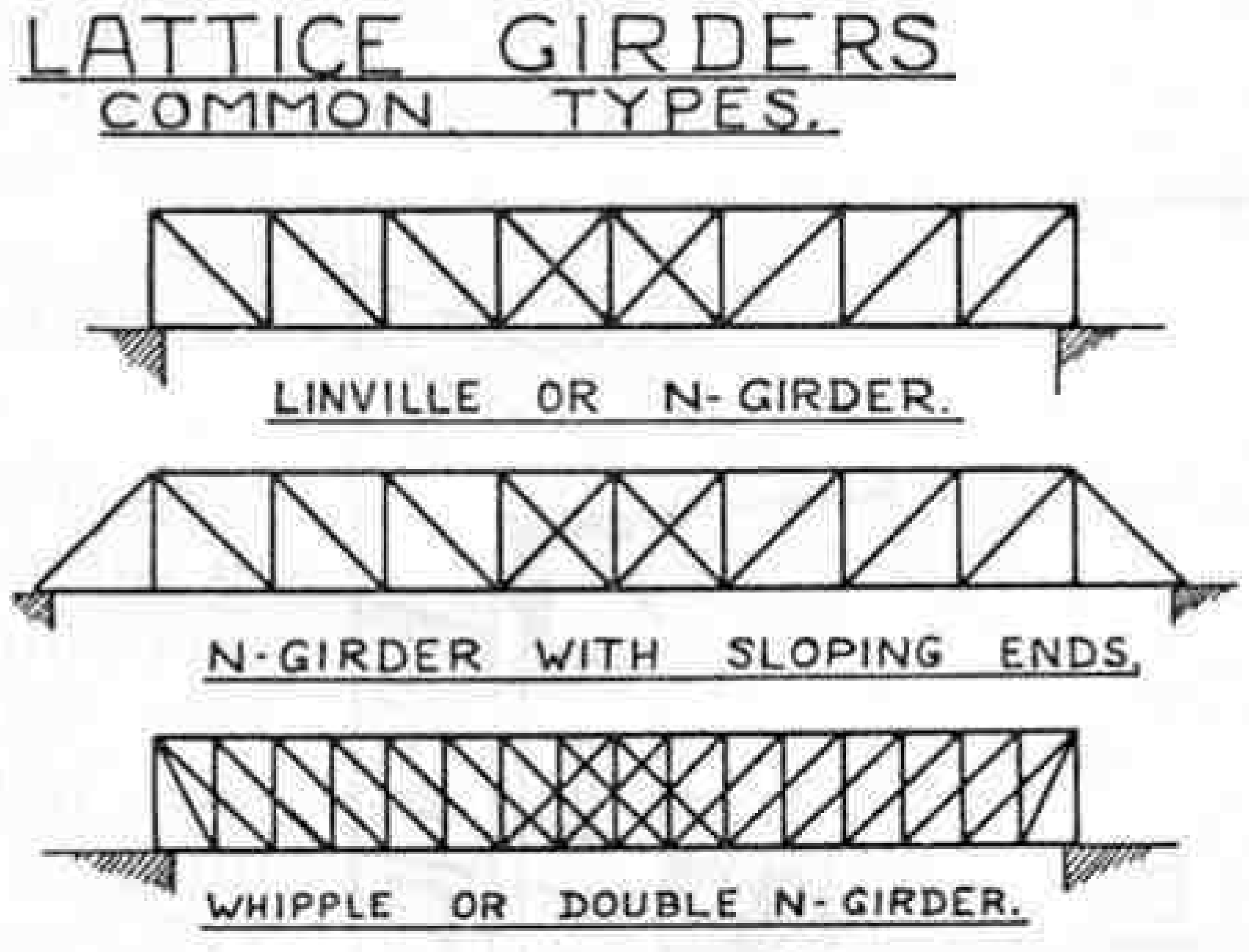
The booms of lattice girders are usually built of two, three or four plates with angles in the corners to form a box-like member.

The upper boom being in compression has to be very solid because a member in compression must, in addition to being big enough to withstand the direct load, be stiff enough to avoid any risk of buckling or bending out sideways. The longer the member, the greater this tendency, and the Whipple or double-N girder has the advantage that the segments of the upper boom are very short. If there are only two plates in the upper chord, it is rendered stiff by a system of cross bracing lacing them together, for which short flat bars are used. The bottom boom has only to resist tension and is usually constructed of two parallel plates, or three plates to form a channel, but there is no need for any cross bracing unless the ends of the girder are finished with vertical posts when the plates are usually laced together in order to resist longitudinal compression that might be caused by a train crossing the bridge with brakes hard on.



The upright vertical members are built up of "channels" or "joists" and being in compression must, like the upper boom members, be stout enough to avoid risk of buckling; the sloping members in tension generally consist of two strong plates alone. The top and bottom booms are invariably built up with a pair of plates so that the ties and struts can pass and be secured between them; a brief examination of any lattice girder bridge will show how this is done. The vertical members are carried right through the bottom boom in most bridges, the cross girders carrying the floor of the bridge being riveted to the extensions. The cross girders must always be fastened to the bottom boom at places where the ties and struts intersect, called panel points; any application of the load between the panel points causes bending of the boom segments, which is undesirable.





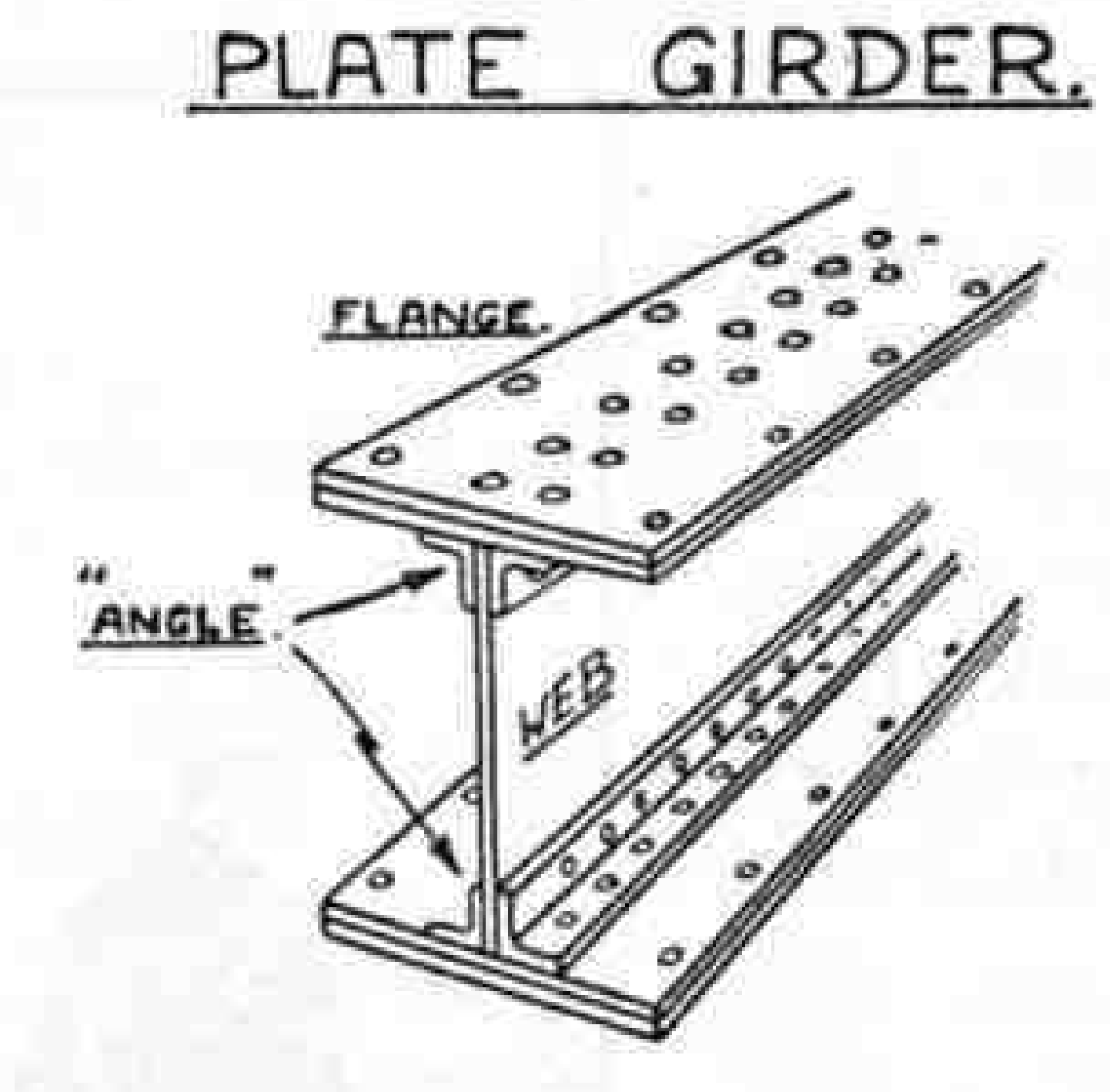


Fig. 2.

The two girders are usually braced with cross frameworks at the top, carried down as far as the railway loading gauge will permit. This stiffens the bridge against the force of side winds, an important factor in the case of large girders.

Girders that are more than about 80 ft. in length have to be provided with pin and roller bearings to allow of free deflection and of expansion and contraction owing to changes of temperature. Each end of the girder rests and is secured on to a strong casting which in turn beds firmly on to a horizontal steel pin, about 30 in. long and 7 or 8 in. in diameter; the pin in turn rests in a suitable socket in a cast steel bedplate, this being secured to the abutment. The deflection of a bridge when a train is crossing is only slight, but the pins permit it to take place without any undue strain being imposed at the ends of the girders. The girders are as a rule made very slightly curved, being an inch or so higher at the centre than at the ends, so that the bridge will be deflected into the true form rather than out of it. At one end of the bridge the bedplate rests on rollers, instead of being fastened down, to allow for expansion in warm weather. The amount of expansion is very slight; it could hardly be measured with an ordinary footrule, but serious strains and probable damage would result to the bridge were it not provided for. The casting which carries the bearing pin, instead of being secured, rests on a set of rollers, six to eight in number, and about 6 in. in diameter, resting in turn on a lower casting resting on the abutment. It is not always easy to see the bearings of a bridge as they are frequently below the ground level, but if the abutment is not too high they can sometimes be observed from below.

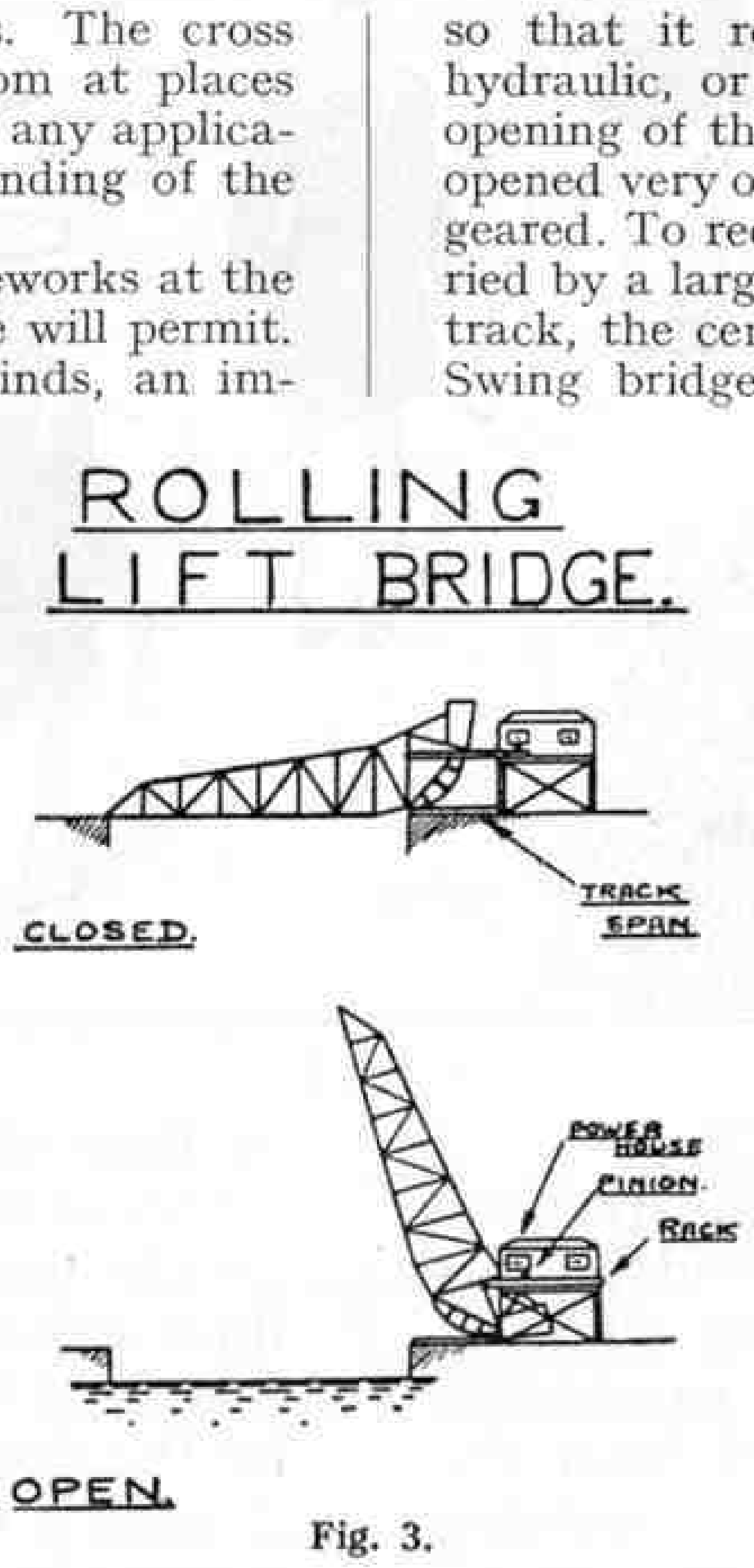


Fig. 3.

For very large spans bridges of special design are built. Most of the world's largest bridges are to be found in other countries, particularly in the U.S.A., for Great Britain is without any very large rivers and valleys to be crossed.

The Forth Bridge (Fig. 1) is the only really big bridge in the British Isles. This bridge, as every one knows, is of the cantilever type and each span consists of a pair of protecting arms reaching towards each other, the gap between their ends being bridged by means of an independent suspended girder. The weight of all these is balanced by projecting arms reaching shorewards and anchored down.

Viaducts consist of a series of short spans, sometimes 20 or 30 in number, carrying the railway over a wide valley. There are numerous examples all over the L.N.E.R. system, at Welwyn, Dinting and Berwick-on-Tweed to mention but three. They are mostly of the stone or brick arch type, but sometimes consist of girders resting on masonry piers. In the early days of the Great Western Railway timber viaducts were largely introduced, and some of them were in use up to a few years ago.

Where a railway bridge crosses a navigated river, an opening span must be provided to permit of the passage of ships, unless the bridge is carried at a great height above the water with long approaching embankments, as on the Cheshire Lines Committee, where the railway crosses the Manchester Ship Canal. Here again a great variety of types is to be found, but the swing bridge is the most common and a well-known example is the Hawarden Bridge, which carries the L.N.E.R. line from Chester to Wrexham over the River Dee. The whole structure is pivoted at or near the centre, so that it revolves in a horizontal circle; machinery, usually hydraulic, or electric in more modern cases, is provided for the opening of the span, although bridges that are not required to be opened very often are sometimes operated by hand winches, suitably geared. To reduce the effort required the weight of the span is carried by a large number of radially set rollers, running on a circular track, the centre pivot being only to keep the bridge in position. Swing bridges have several disadvantages however. The whole movable span is carried by one foundation, and should this move or sink in the slightest degree the bridge would be unable to function properly; the foundation is usually placed almost in the centre of the river, so that the pier it carries supporting the bridge is in constant danger of damage from collisions with ships, while a strong wind will often interfere with the opening and closing of the span.

The most modern type of opening bridge is the rolling lift type illustrated in Fig. 3. It has none of the swing bridge's failings. The rolling lift bridge, of which the L.N.E.R. has an excellent example at Keadby, has one end of each main girder curved up with a balance weight above so that the whole bridge can be rolled back, rising to a vertical position as it does so, like a drawbridge. The power house is stationed at the end, usually on a gantry, over the railway, and operates a pair of large racks coupled to the girders of the bridge, and when this is wound to and fro, the bridge is raised or lowered as required. The segmental, or curved, portions of the girders have to be very stoutly built as they have the whole weight of the bridge to carry when it is open. The paths on which the girders roll are called the track spans, and these too, must be very substantial.

The maintenance of the company's bridges is very important work and is attended to very thoroughly. Every few years all the steelwork is scraped, any parts that have weathered thin replaced, and the joints well dressed with red lead, the whole structure being finally carefully painted. Grey or dull red are the usual colours, for unfortunately paint of the most attractive shades is usually expensive.

We are indebted to the courtesy of the Editor of the "*London and North Eastern Railway Magazine*" for permission to reproduce this article and the accompanying diagrams.

How our Eyes are Deceived

Some Amusing Optical Illusions

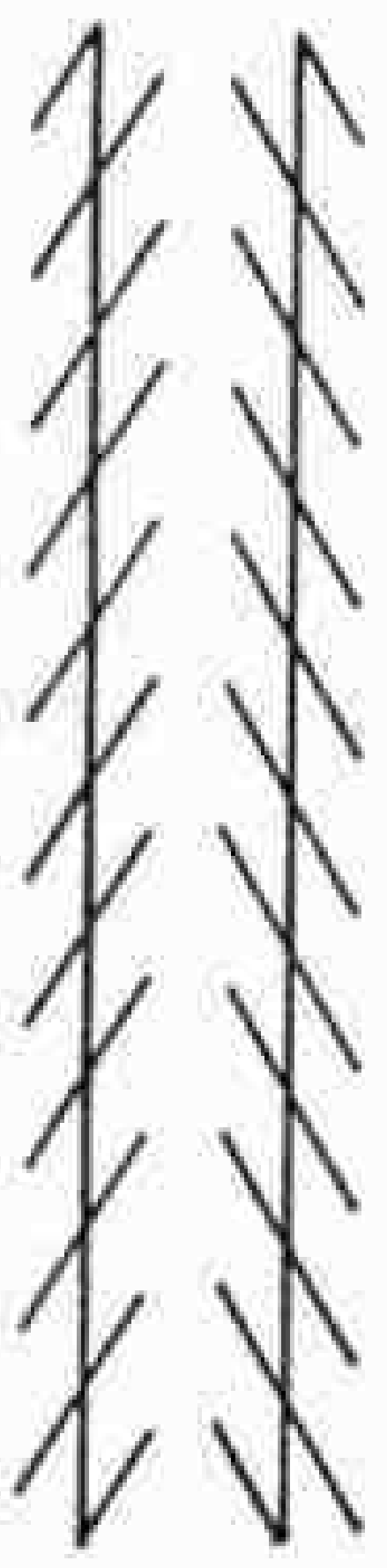


Fig. 1.

"SEEING is believing," we say, and most of us rely on our eyes as the final test of truth. Actually, however, our eyes have serious defects, which sometimes lead to our gaining very wrong impressions of things we see. The camouflage or "dazzle painting" of ships during the Great War was a striking example of the ease with which the eye can be deceived. By the use of various colours laid on in all kinds of weirdly shaped bands, curves and spots, the true perspective of a ship was altered to such an extent that it was very difficult for an observer to grasp the real shape of the ship, or to form an accurate estimate of its speed and course.

Some astonishing illusions were created by this means. For example, long vessels were made to look short and fat, while short tubby vessels appeared long and slender. A skilful "dazzle" painter could easily disguise the bows and stern of a ship so that they appeared to have changed places, thus making it extremely difficult to tell from a distance in which direction a ship was travelling. It was even possible to make a large ship appear to be two smaller ones, one towing the other!

An instance of optical illusion that is familiar to all "*M.M.*" readers is that of the films projected on a cinema screen. Actually the films are a succession of "still" photographs, each slightly different, which are projected in such rapid succession that our eyes fail to note the minute fraction of time during which each picture is giving place to the next, and we see the film as a record of uninterrupted movement.

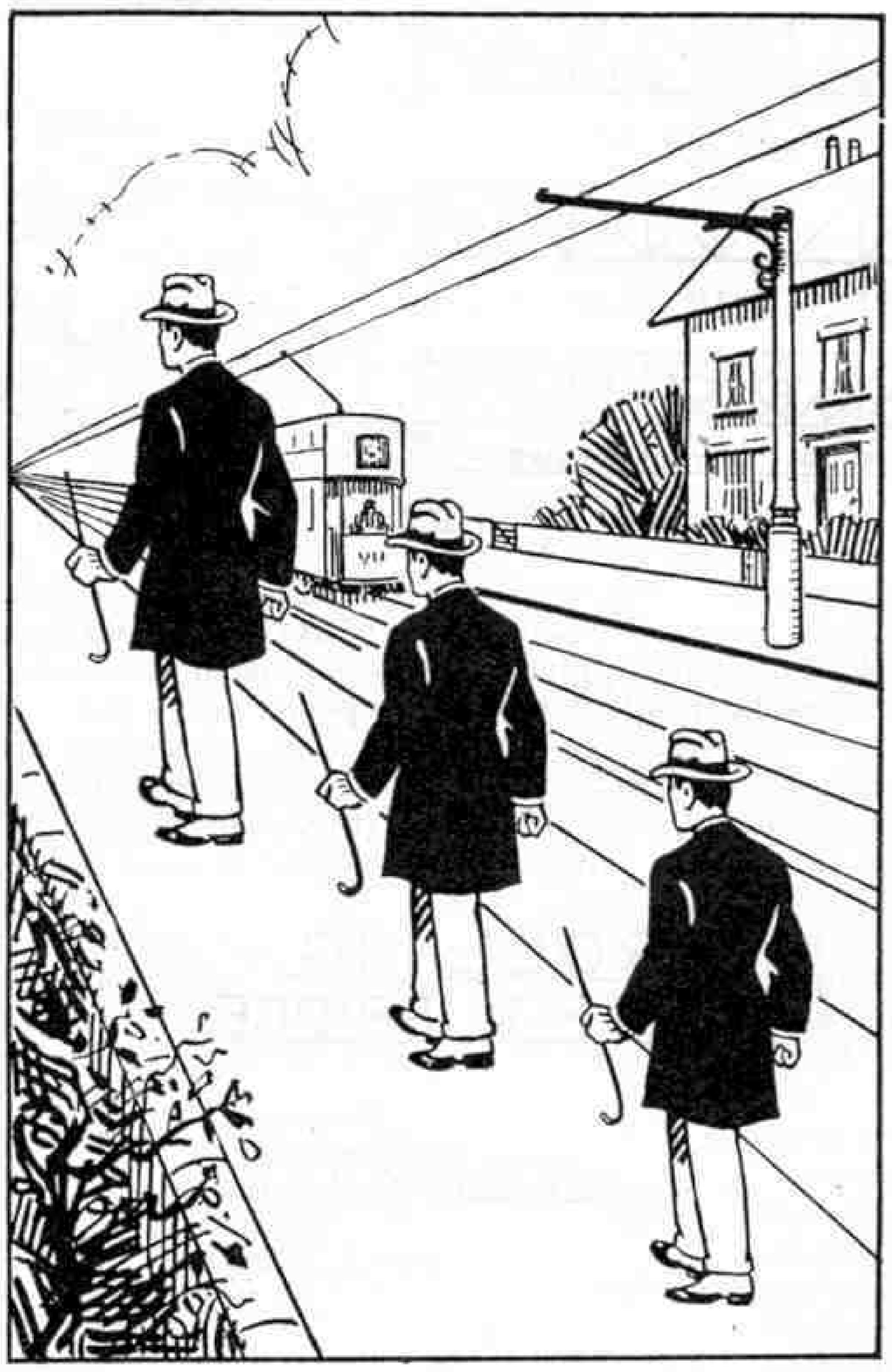


Fig. 2.

Even when regarding stationary objects or illustrations our eyes do not always record the truth, and in this article we describe a selection of interesting illusions that bear out the statement made in the first paragraph.

The "wobbling" of light rays on the way from the object to the retina of the eye produces some interesting illusions with which we are all familiar. For instance, we have all noticed the quivering, waving effect produced above a source of heat, such as a night watchman's glowing coke fire, or a gas jet. This effect is due to distortion of the light rays by the movement of the heated air, and any object looked at over the gas jet or fire appears to be quivering also, although really it is still.

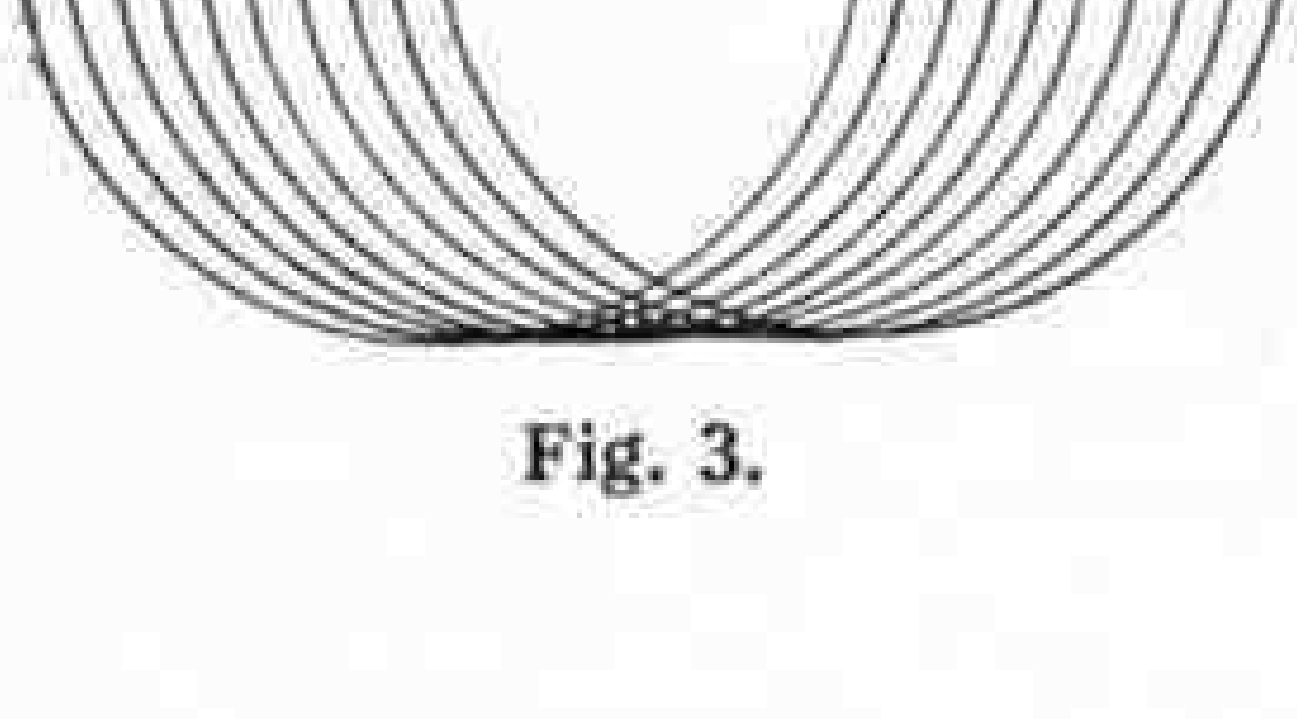


Fig. 3.

The wonderful mirages seen by travellers in the Sahara Desert are other examples of illusions produced by light distortion. The hot air rising from the sand may distort the light rays to such an extent as to make the trees of a far-away oasis appear many miles nearer than they actually are, to the bitter disappointment of weary and thirsty travellers! On other occasions a portion of ground some distance ahead may disappear from sight and in its place there will apparently be a lake, out of which tall objects, such as trees, appear to rise, while their reflections are seen in the waters of the imaginary lake. Sometimes inverted images of distant trees and ships are seen near the horizon beneath the direct images.

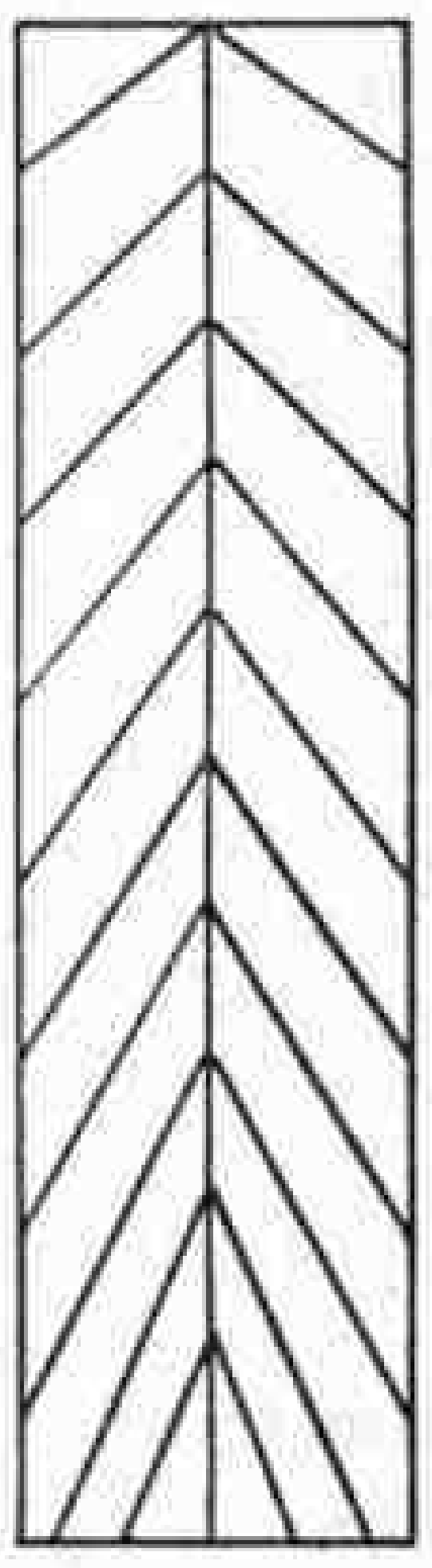


Fig. 4.

Mirages are rarely seen in winter, and the fact that they sometimes occur in the Arctic regions is due to the rapid evaporation that takes place in a hot sun from the surface of the sea, and the unequal density caused by partial condensation when the moist air becomes chilled by its passage over large surfaces of ice.

An interesting optical illusion can be demonstrated by thrusting part of a stick into a pond, or by putting a pencil partly into a basin of water. The stick or pencil immediately appears to be bent at the water surface, although we know that actually it is quite straight. The cause of this illusion is refraction, that is the bending of rays of light as they pass from one medium to another.

One of the simplest optical deceptions is brought about by the use of diagonal lines. In Fig. 1 the two vertical lines appear to converge from top to bottom, but as a matter of fact they are parallel. The illusion is produced by the diagonal lines, which upset our sense of direction. A similar effect is shown in Fig. 4, where the rectangle is made to appear to narrow from top to bottom, whereas it is really quite symmetrical. The interest of these two figures will be increased if they are turned upside-down and the effect noted.

Other types of illusions are shown in Fig. 3, Fig. 8, Fig. 12 and Fig. 13. Fig. 3 is apparently a

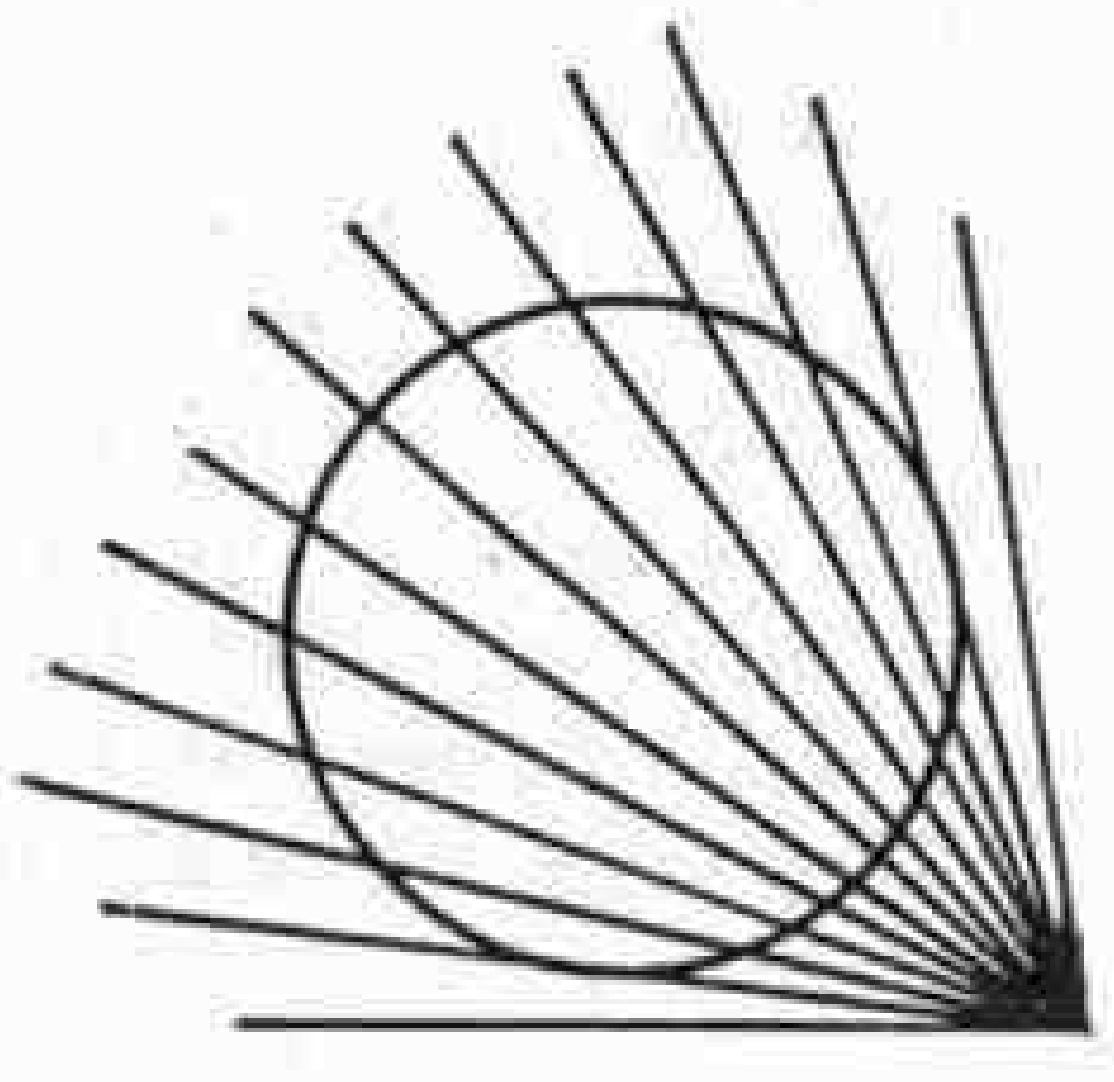


Fig. 5.

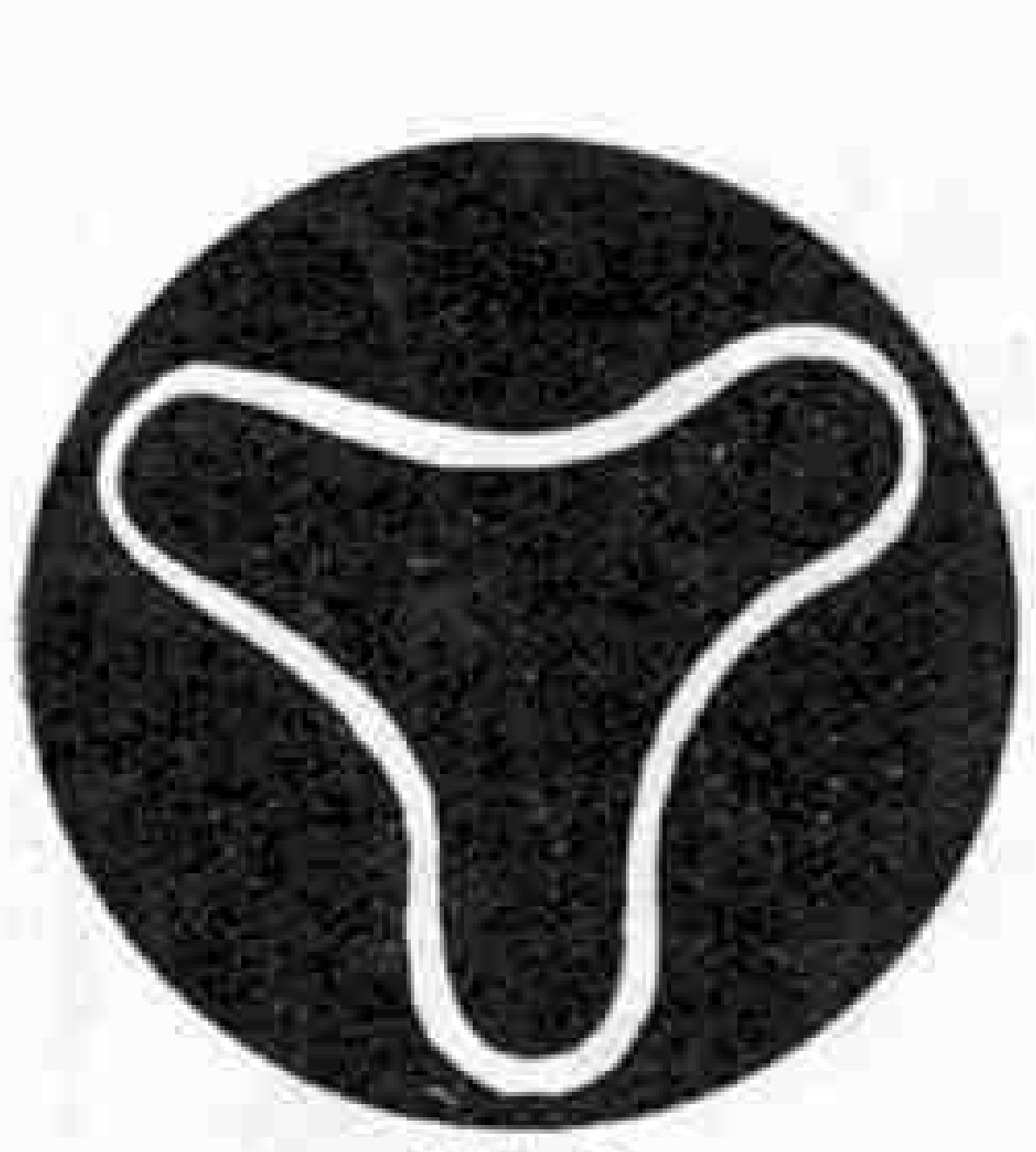


Fig. 6.

normal drawing, but as we watch it it suddenly turns over. Whereas we thought we were looking through a sort of tube from right to left, we suddenly find that we are looking through one from left to right, and *vice versa*. Similarly in Fig. 8 appears to be a top view of a pile of cubes, but as we gaze at it, it appears to become inverted and we suddenly have the impression that we are gazing upward at the cubes. In Fig. 12 the perspective of the sketch is so definite that in this case also the formation appears to change as we look at it. At first Fig. 13 appears to show a top view of a flight of steps and then, as we watch it, the whole thing appears to turn over and we see an underneath view of steps!

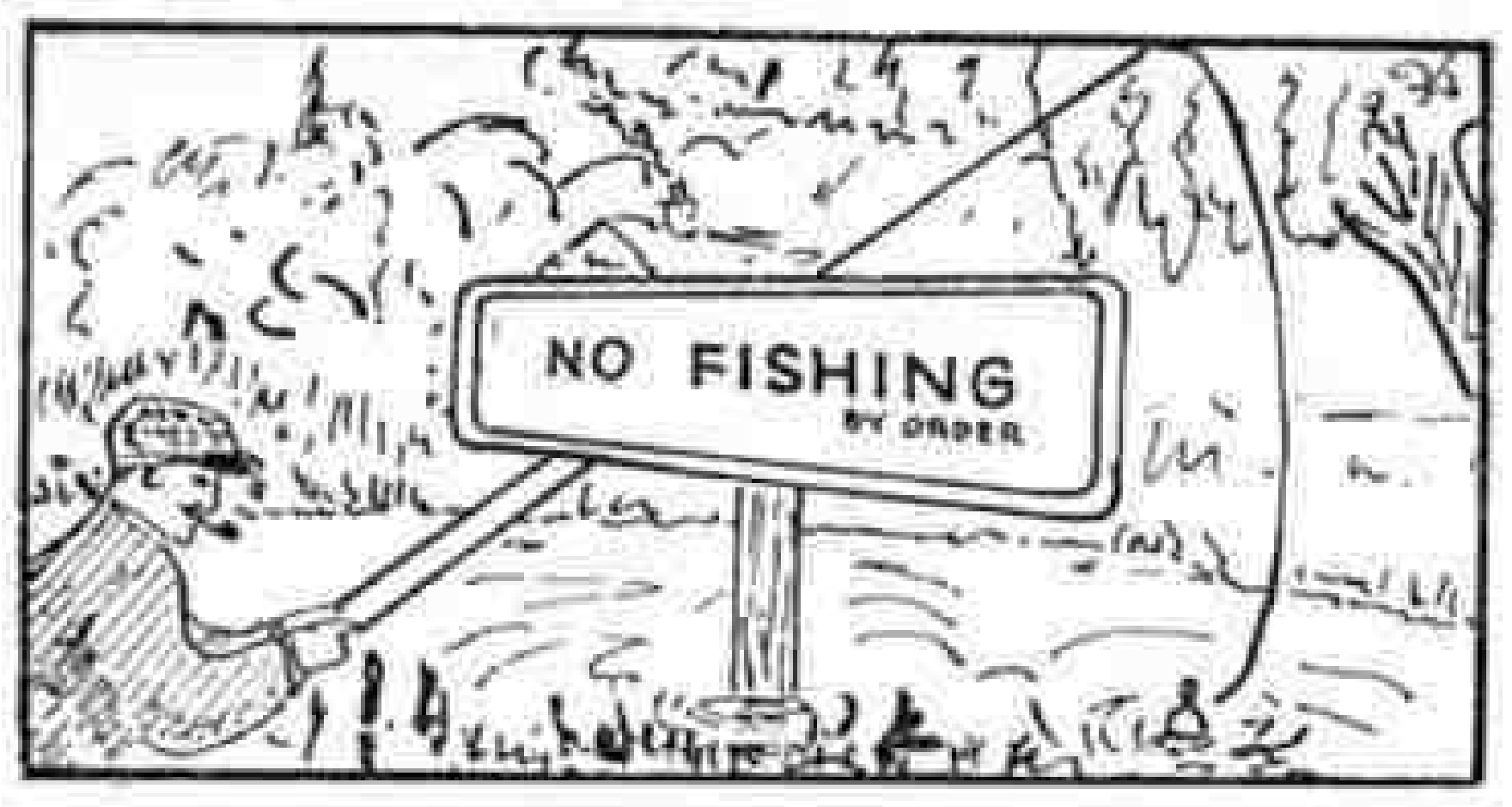


Fig. 7.

The curious thing about illusions of the type just mentioned is that we cannot do anything to prevent them. In spite of our efforts to the contrary, if we look at the figures steadily they suddenly turn themselves over, and just as suddenly turn back again.

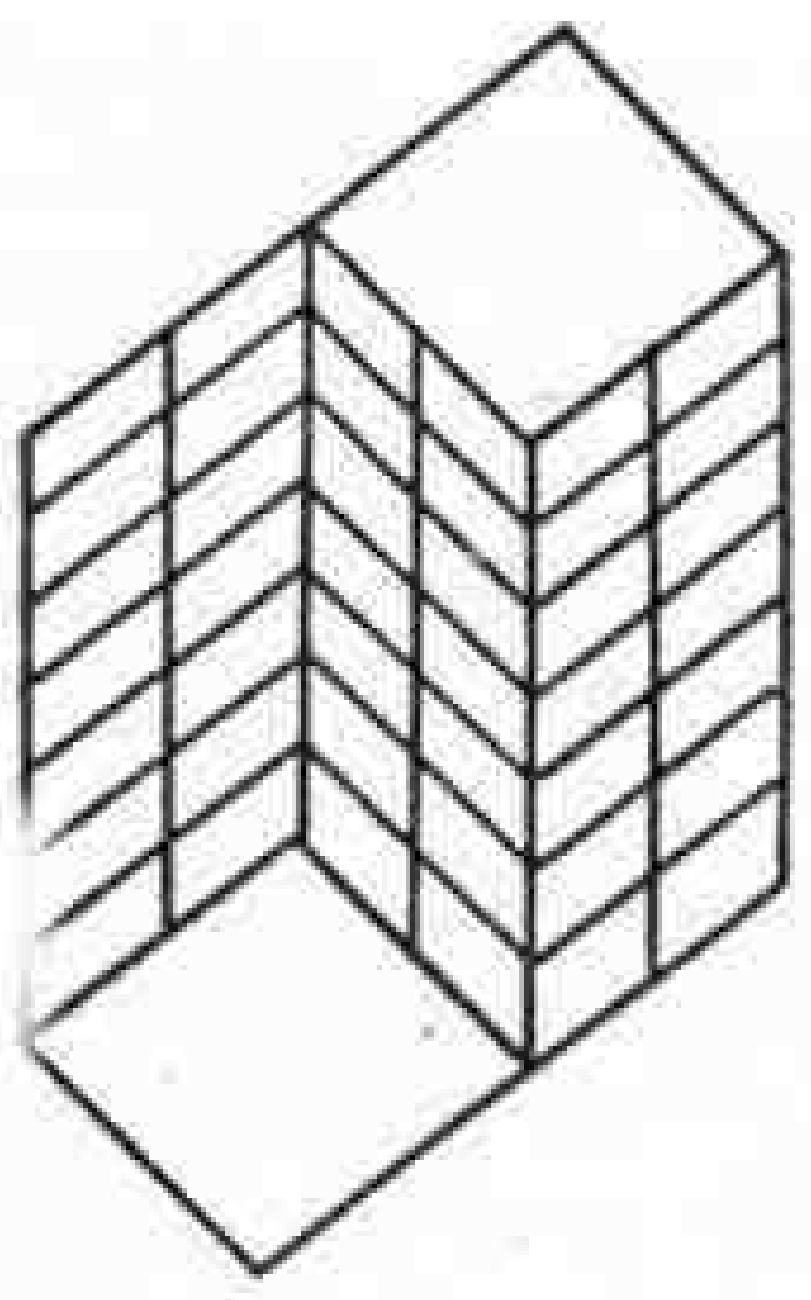


Fig. 8.

Another very interesting type of illusion is caused by irradiation. Owing to the imperfection of the eye, the image of a luminous point on the retina is never perfectly sharp, and because of this a white object on a black background always appears larger than a black object on a white ground. In Fig. 9 the black square is slightly larger than the white one, as may be verified by actual measurement, but it appears similar. The images of luminous points on the edges of the white square appear to invade the black border, and similarly the white border appears to extend into the black square.

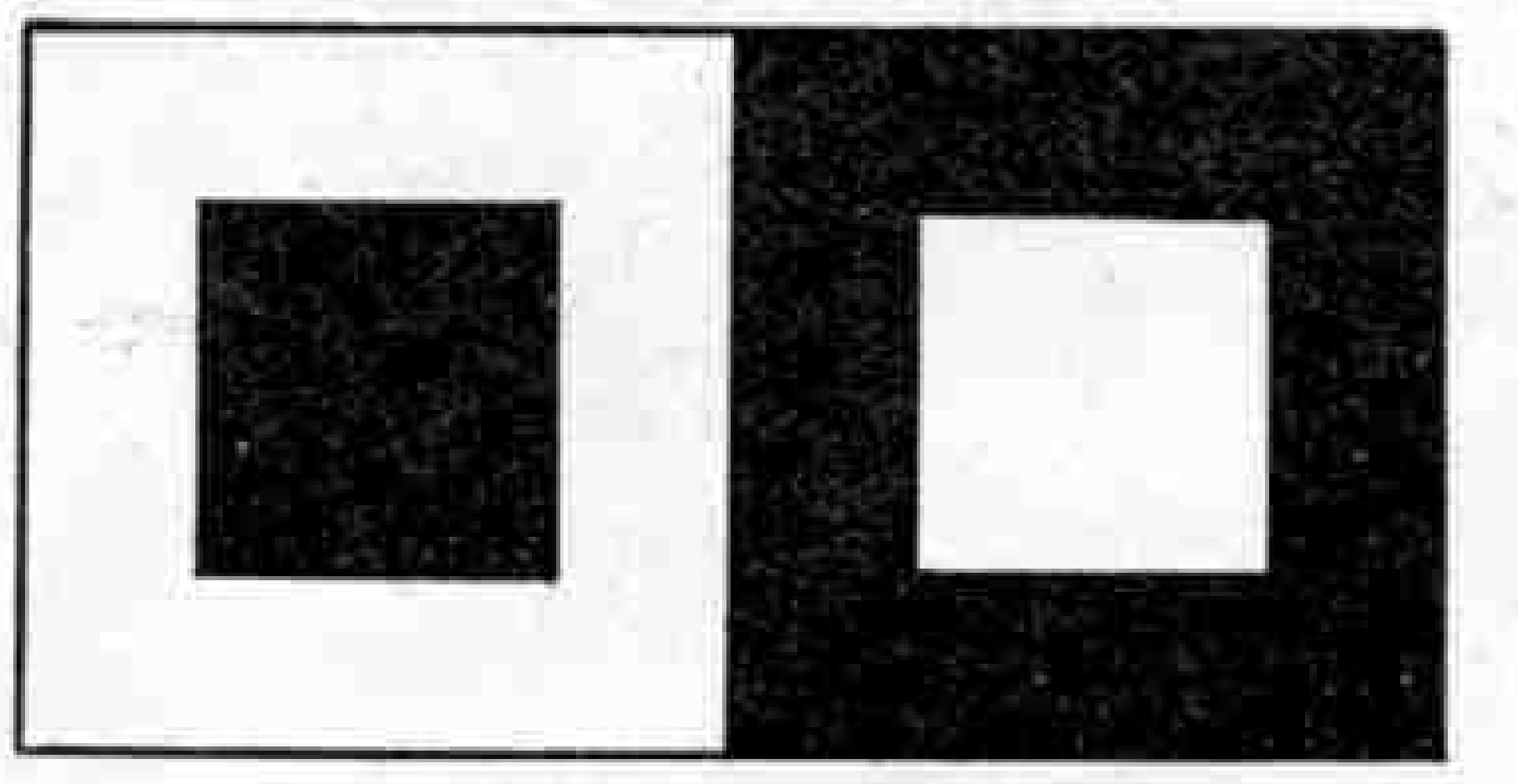


Fig. 9.

Fig. 11 is a striking example of eye deception of another kind. In this the square appears to be distorted inward because of the concentric circles superimposed on the straight lines. The four heavy lines forming the square, however, are perfectly true.

Another interesting illusion of this kind showing the effect of diverging lines is given in Fig. 5. In this case a circle is drawn against a background of diverging lines, with the result that one half of the circle appears to be flattened while the other half seems to bulge outward. A pair of compasses will show, however, that the circle is perfectly true.

Still another fascinating example of a simple optical illusion is shown in Fig. 10. At first glance the design appears to be formed from a number of oblongs, but if you study the design more closely you will see that it is really made up by one continuous line.

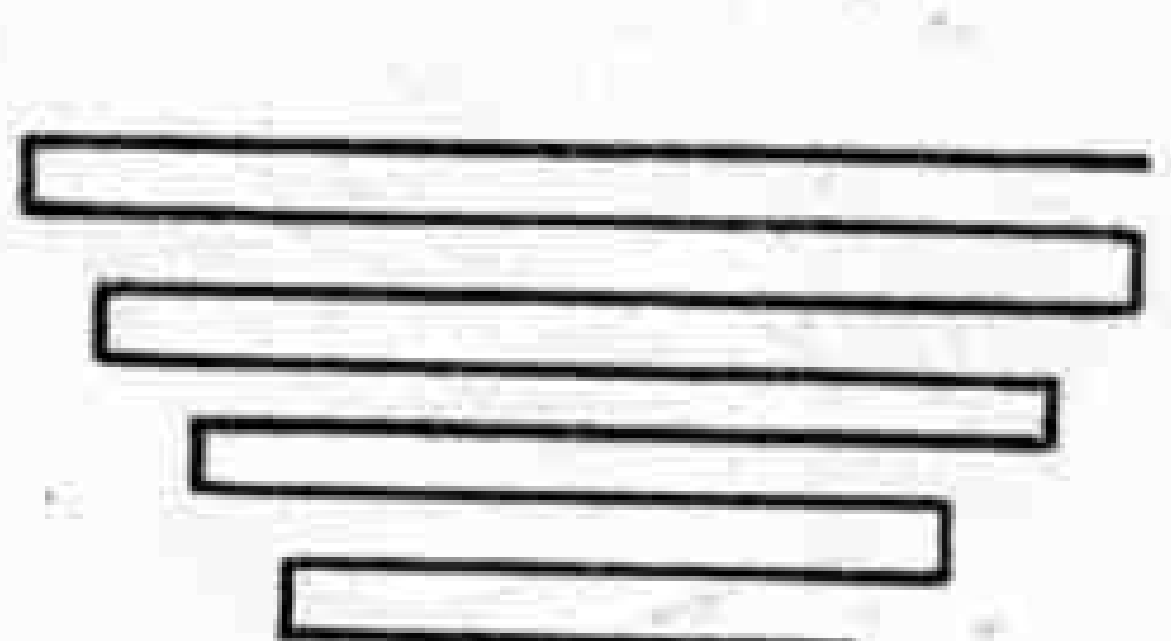


Fig. 10.

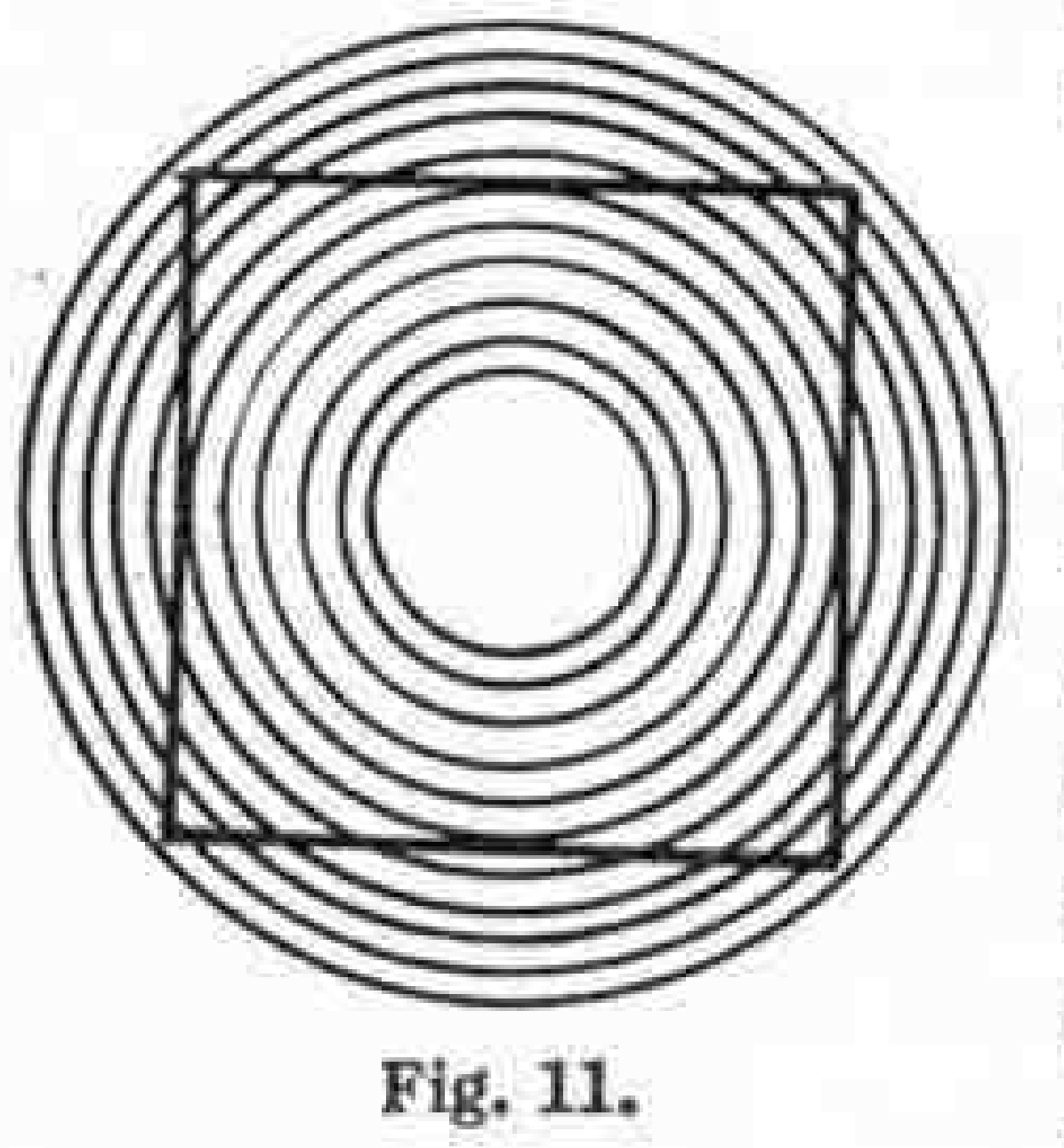


Fig. 11.

Another direction in which the eye often fails us is in its capacity to estimate breadth. If, for example, we draw several squares on a piece of paper, estimating the length of the sides by eye, without turning the paper round, and then measure the drawing with a ruler, we find that the breadth is about five per cent. greater than the height.

In a similar way the eye misjudges the size of letters and figures. As an illustration of this it may be mentioned that the upper part of letter S or figure 8 is smaller than the lower part, but most of us are accustomed to regard them as of the same size. The difference in size at once becomes apparent if we invert this letter and figure.

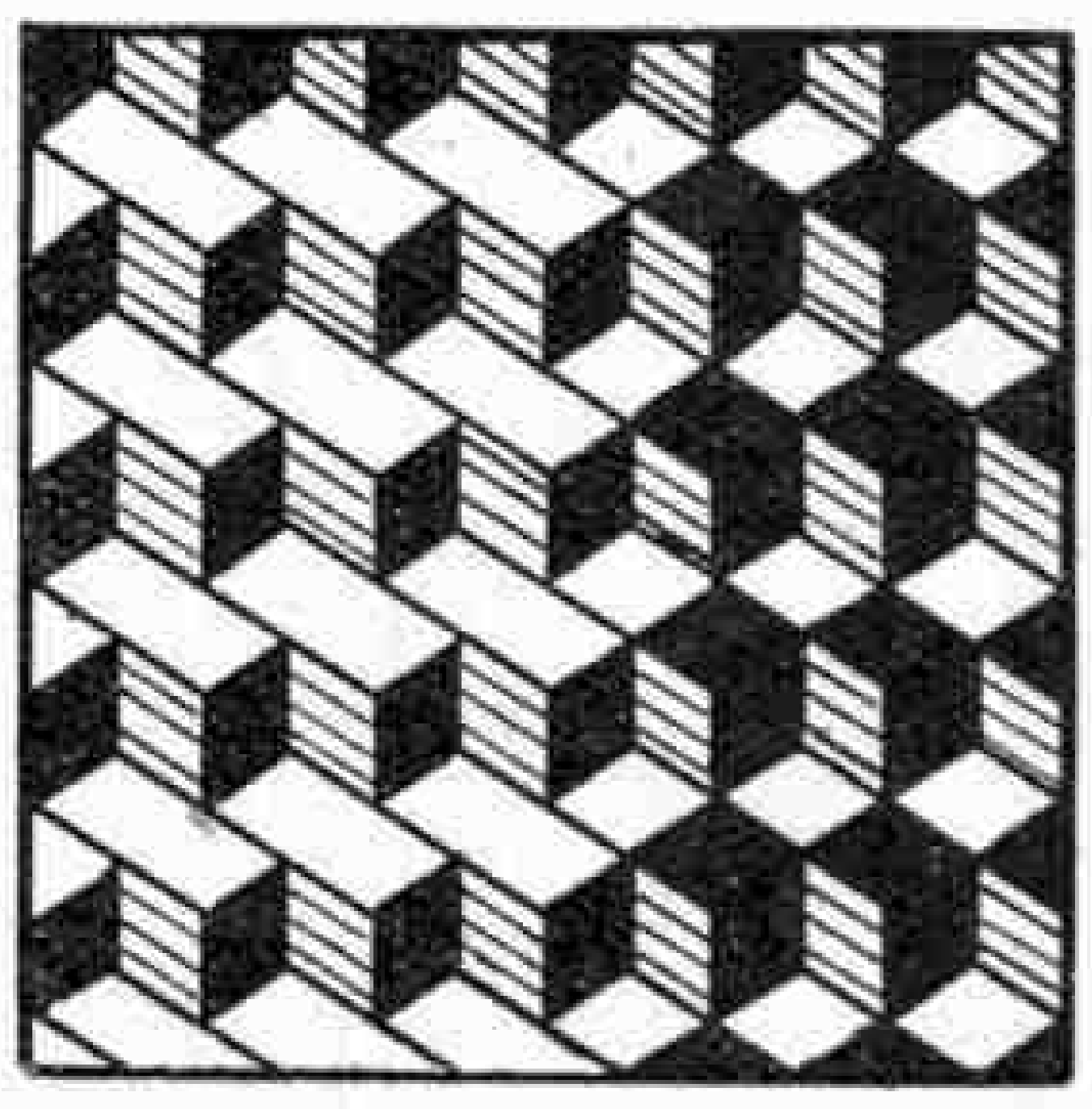


Fig. 12.

Many interesting illusions can be created by the simple means of drawing part of a sketch in perspective and part not, and a good example of this is shown in Fig. 2. Here is a picture of three men all dressed alike and standing in the same attitude. The left-hand man appears to be larger than the centre man and the latter larger than the right-hand man. Actually all the figures are the same size and it is this fact that produces the illusion. Each of the figures is placed at a certain point of the picture without any reference to the perspective, and because of this the eye is deprived of any means of estimating their actual size.

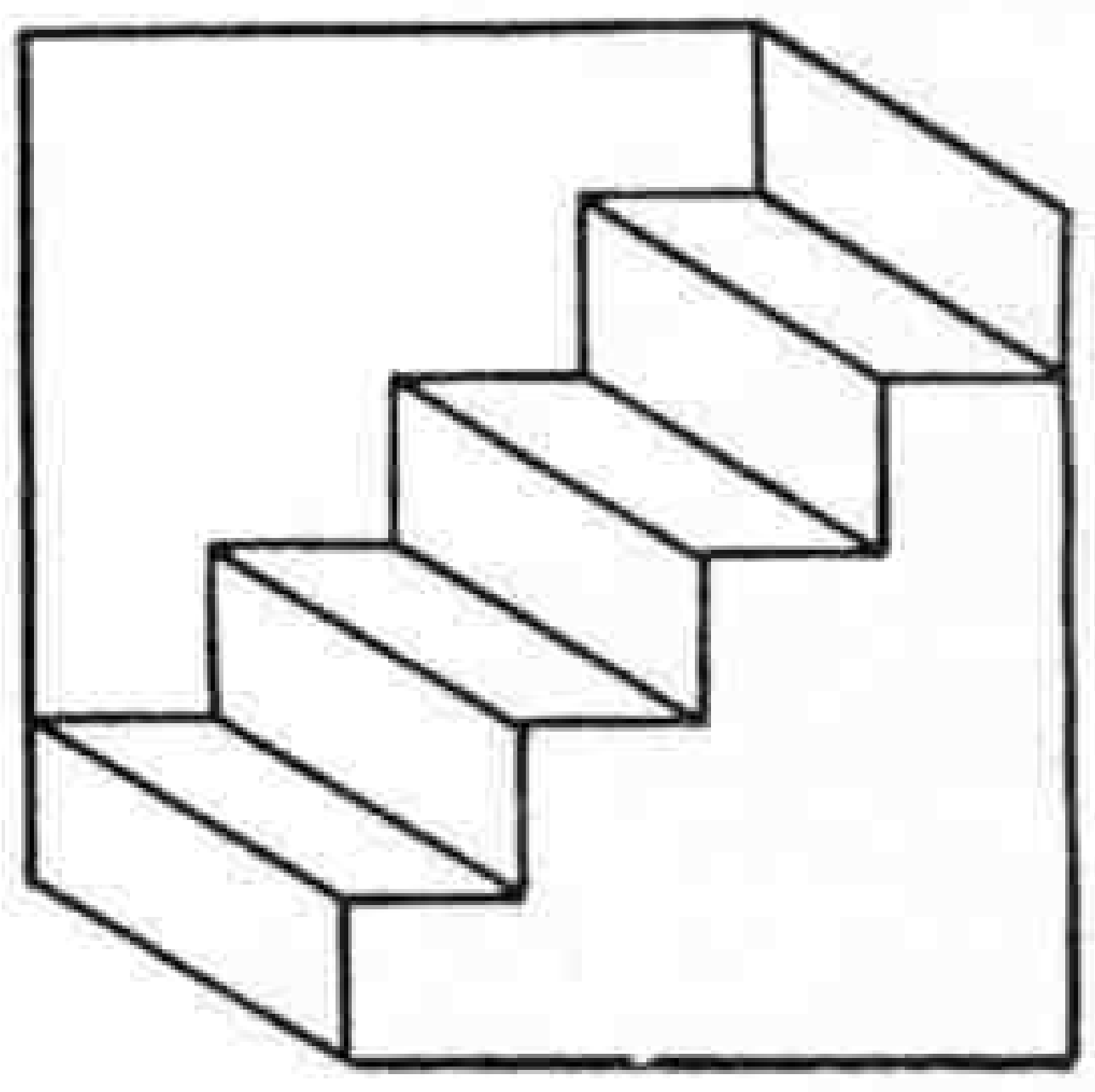


Fig. 13.

An illusion that produces a most curious effect can be demonstrated by means of a small device that you can easily make for yourself. Two rounds of stout white cardboard are required, and on the first one is drawn the design shown in Fig. 14. It will be seen that there are two large circles that overlap, and in the central part there is one much smaller circle. It is a good thing to paint the circles in different colours. For example one might be red, the other blue, and the small circle deep yellow. Make a hole in the centre of the cardboard through which can be pushed a short bit of pencil or a similar piece of wood, to form a peg for a top. If the disc is now spun using the pencil point as a pivot in a similar manner to a top, a most curious effect will be seen for the large circles will appear to turn independently round the small one just as if they were separate wheels.

On the other disc of cardboard a wavy line such as is shown in Fig. 6 is drawn. The line should be white, and all the other part of the disc should be painted black. A piece of pencil for a pivot is fitted and then the disc is spun rather slowly. The line will be seen to roll round the card circle just like a curious kind of snake.

Fig. 7 illustrates a particularly good illusion with which to "catch" your friends. A man is shown fishing with a rod that apparently has two handles. If you ask your friends to say which is the right handle, the upper or the lower one, you will find that probably all of them will say the bottom one. Actually the upper handle is the correct one, as a straight edge will reveal.

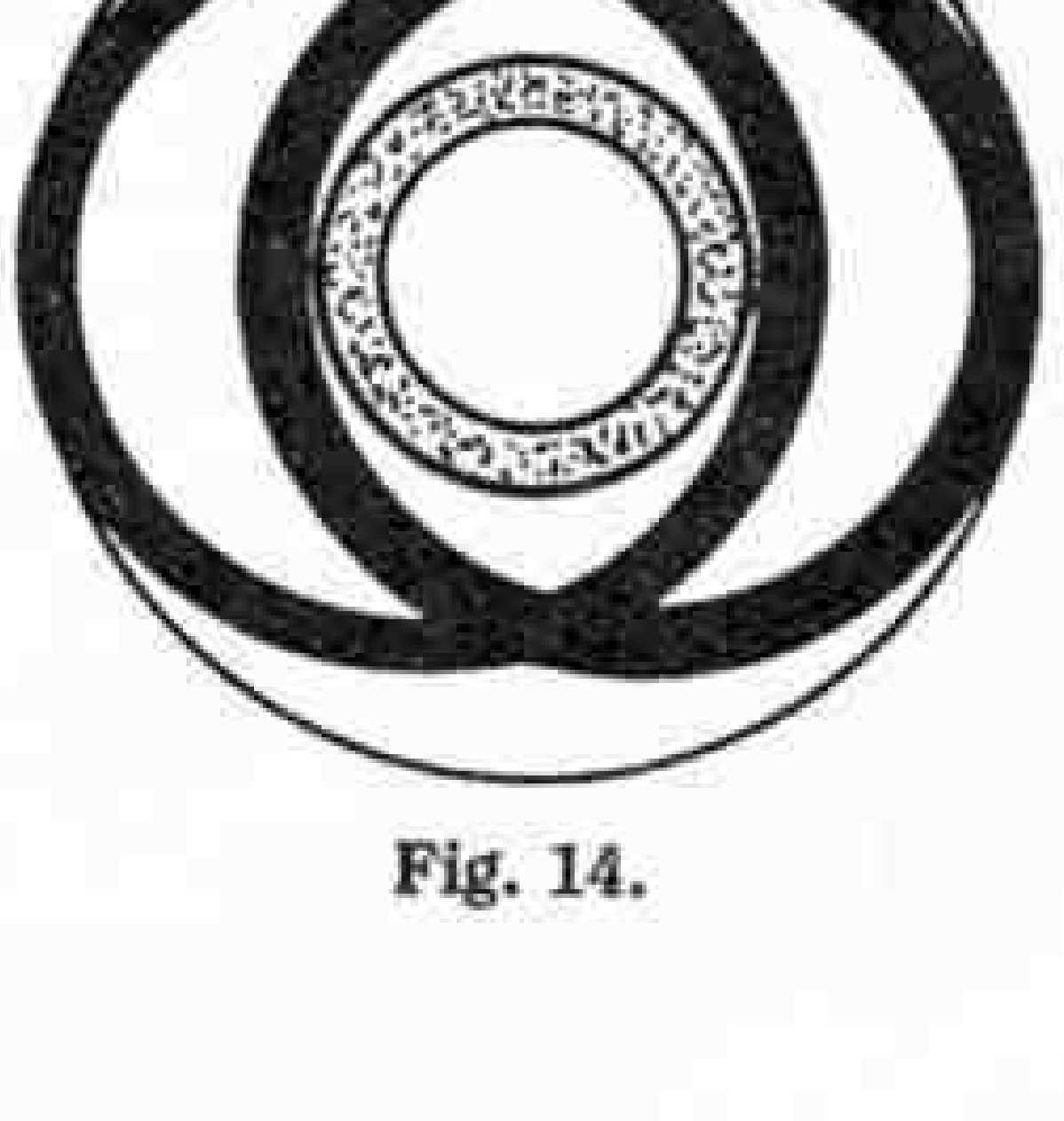
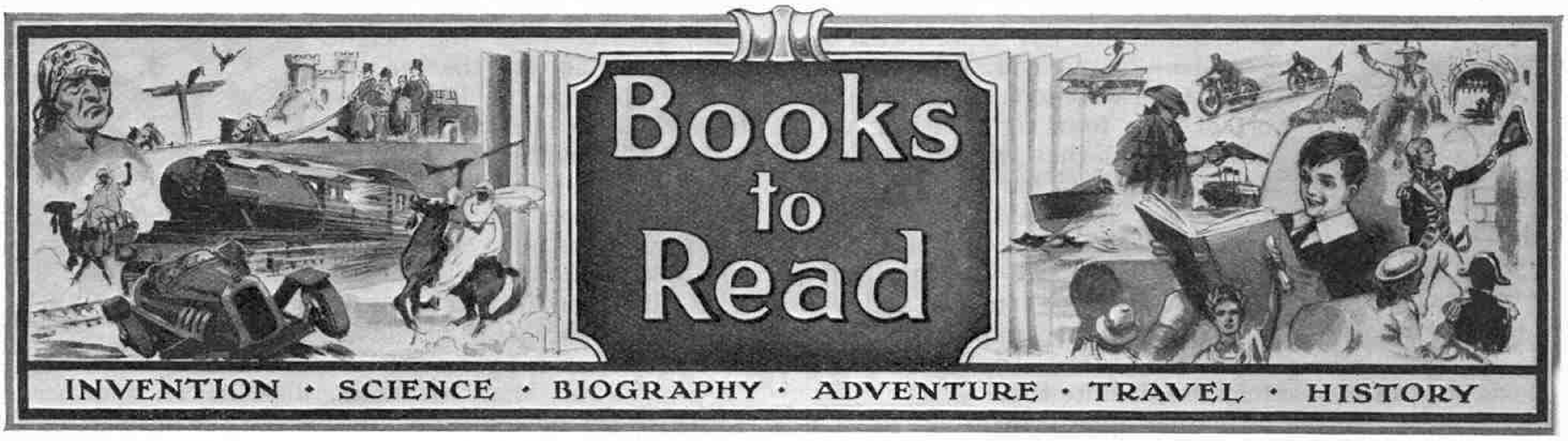


Fig. 14.


Books to Read
INVENTION · SCIENCE · BIOGRAPHY · ADVENTURE · TRAVEL · HISTORY

Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books varies, but any balance remaining will be refunded.

"Snow Baby"

By M. A. Peary. (Routledge. 6/- net)

"*Snow Baby*" was the name given by the Eskimos to the daughter of Peary, the famous Arctic explorer. It is very suitable, for she was born in Greenland at a point farther north than any other white child. Her real name is Marie Ahnighito Peary, and Ahnighito is the name of the Eskimo woman who made the child's first suit of fur clothing.

This book is Marie's account of her childhood and girlhood, and particularly of her visits to the Arctic during some of her father's expeditions. It bears out her statement that she had "the happiest and most exciting childhood that anyone could wish to have." She tells of thrilling hunts for seals, walrus and polar bears; of long sledge rides behind sturdy Eskimo dog-teams, and of the dramatic race for harbour before the ice froze for the winter.

One autumn the relief ship "*Windward*," with Marie and her mother on board, was frozen-in before they could reach Peary's station, and they had to spend the whole dark winter on board, waiting as patiently as they could for the spring thaw to release the ship. When it became clear that the "*Windward*" was icebound for the winter, the Eskimos on board at once proceeded to build themselves winter houses on shore, as under such conditions they could keep warmer with less fuel and be less crowded than on the ship. Marie gives a detailed description of how they set about their task, and of her own enthusiastic efforts to help one family of builders with whom she was on very friendly terms. The hut-building proceeded rapidly, and soon "a whole village of little white mushrooms seemed to have sprung up on the shore close to the ship."

She mentions the interesting fact that throughout the winter "it was seldom so dark that we could not venture out" for a walk. "The snow and ice reflected what little light there was and we soon became accustomed to it." Her descriptions of everyday life among the Eskimos gives an insight into their simple mode of living, their habits and their manner of dress.

The book also contains glimpses of what Arctic exploration really means—the months of preparation, the getting together of the necessary men, dogs and food, and the final dash over the frozen sea, only to be stopped by an open channel in the ice which may or may not freeze over before the provisions are exhausted.

The book is written in a simple style, and is generously illustrated by excellent photographs.

Marie Ahnighito Peary, the daughter of the famous Arctic explorer. She was born in Greenland, where the Eskimos called her "Snow Baby." (From "Snow Baby" reviewed on this page.)

"The Modern Book of Railways"

By W. J. Bell, M.I.Loco.E.
(A. and C. Black Ltd. 5/- net)

All boys like a railway book, and especially one that contains plenty of interesting illustrations; and "*The Modern Book of Railways*" should therefore have a wide appeal among our readers. The scope of the book is very extensive. The important services afforded by the chief railways of to-day are dealt with, and interesting information is included on both passenger and goods trains. Railway operations generally are discussed, and useful notes are included on the permanent way, tunnels, signals and other items of equipment. The steam locomotive is of course given special attention. Its history and development are briefly traced, and famous engines of the past, and some of their feats, are included in the survey. Present-day engines for passenger and other duties are dealt with, and a separate chapter is devoted to unusual types, such as high-pressure, articulated, turbine and geared locomotives. Examples of up-to-date motive power for overseas service are illustrated and described, and it is of special interest to have available in the same book the necessary material to enable one to compare these locomotives with British types.

The illustrations generally are good and their reproduction satisfactory. Among them are such famous "old-timers" as the Stirling 4-2-2 single-wheeler "No. 1" and the former L.N.W.R. "*Cornwall*," both luckily still in existence, also one of the Brighton "Gladstones," of which class "*Gladstone*" itself is a companion of "No. 1" in the York Railway Museum. Modern favourites such as "Pacifics," "Kings," "Schools" and "Royal Scots," and the trains they haul, are well to the fore, and opposite each illustration are interesting details concerning each engine or train.

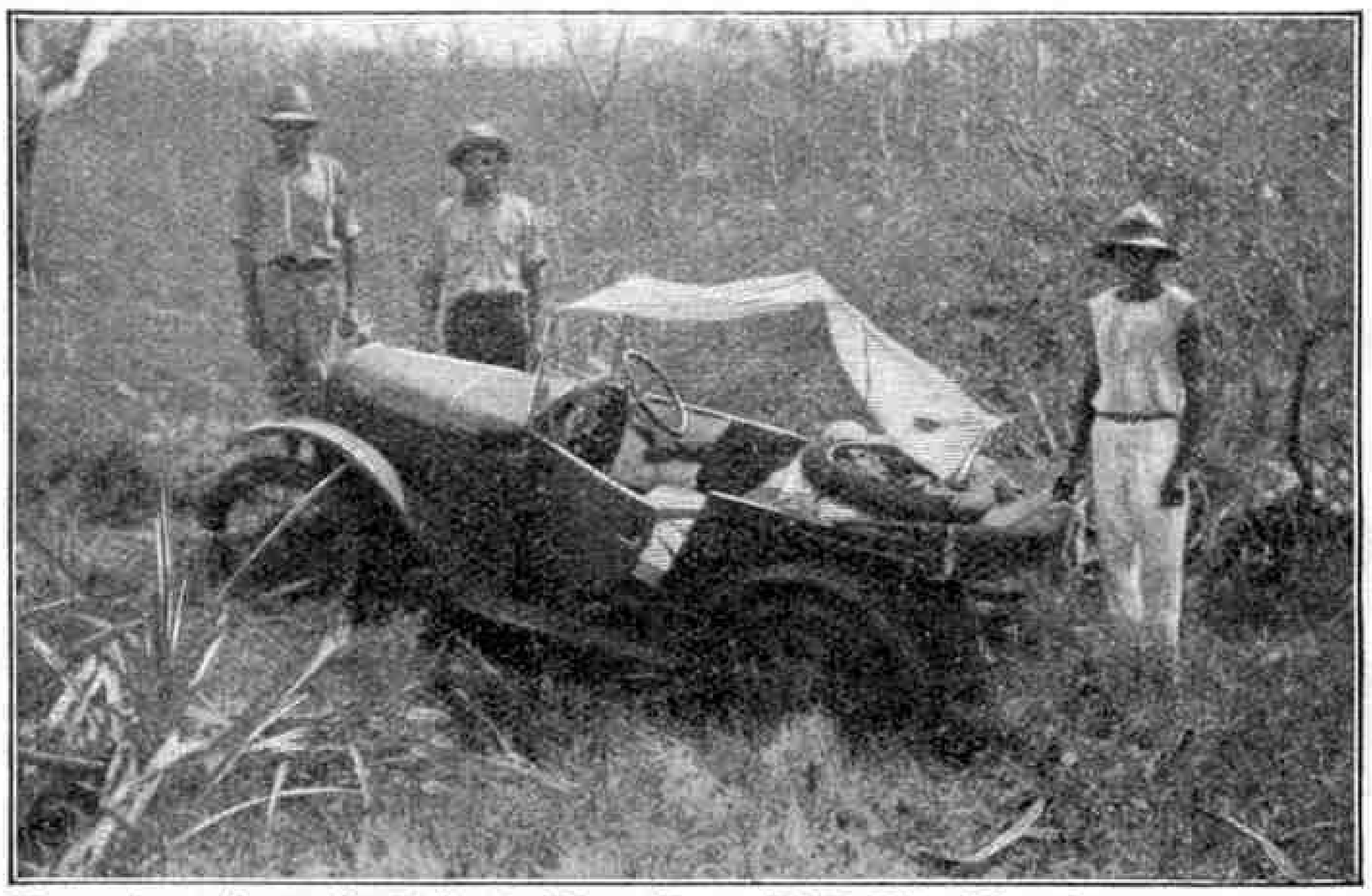
It is difficult to break new ground in a popular railway book, but in "*The Modern Book of Railways*" there is decided novelty in the method of presentation. The book succeeds very well in its attempt to make an interesting story of railway activities in general, and the developments of modern times in particular. It has an attractive coloured wrapper showing an excellent picture of the L.N.E.R. giant "*Cock O' The North*."

"Little Wheels"

By Hector MacQuarrie. (Bodley Head. 5/- net)

The author gives a racy account of a remarkable journey by motor car through rough country from south to north of Australia. It is a tale of an unpremeditated joyride in a "baby" car, undertaken by two young men out for adventure. Their luggage weighed about 4 cwt., the only spares carried being one complete wheel and some spokes. The trip commenced at Sydney, and the first part of the journey, 1,500 miles to Cairns, is covered without any mention of incident. The real story commences from this point on the east coast, from which the remaining 500 or 600 miles of the journey north were made in roadless country to Cape York, more or less following the line of telegraph stations. Along some 200 miles of this route a motor car had never been seen. There were scores of silent miles punctuated by contact with lonely telegraphists, outpost traders, and black "gins" with their strange pidgin jargon.

The book contains a series of thrilling incidents that occur in the process of getting out of the difficulties necessarily encountered in taking a light car over such virgin ground. The author describes the country well, and gives an excellent idea of the trials the two travellers had to face, and of the remarkable manner in which the "Baby Austin" stood up to the strain. The book contains a map and photographs.



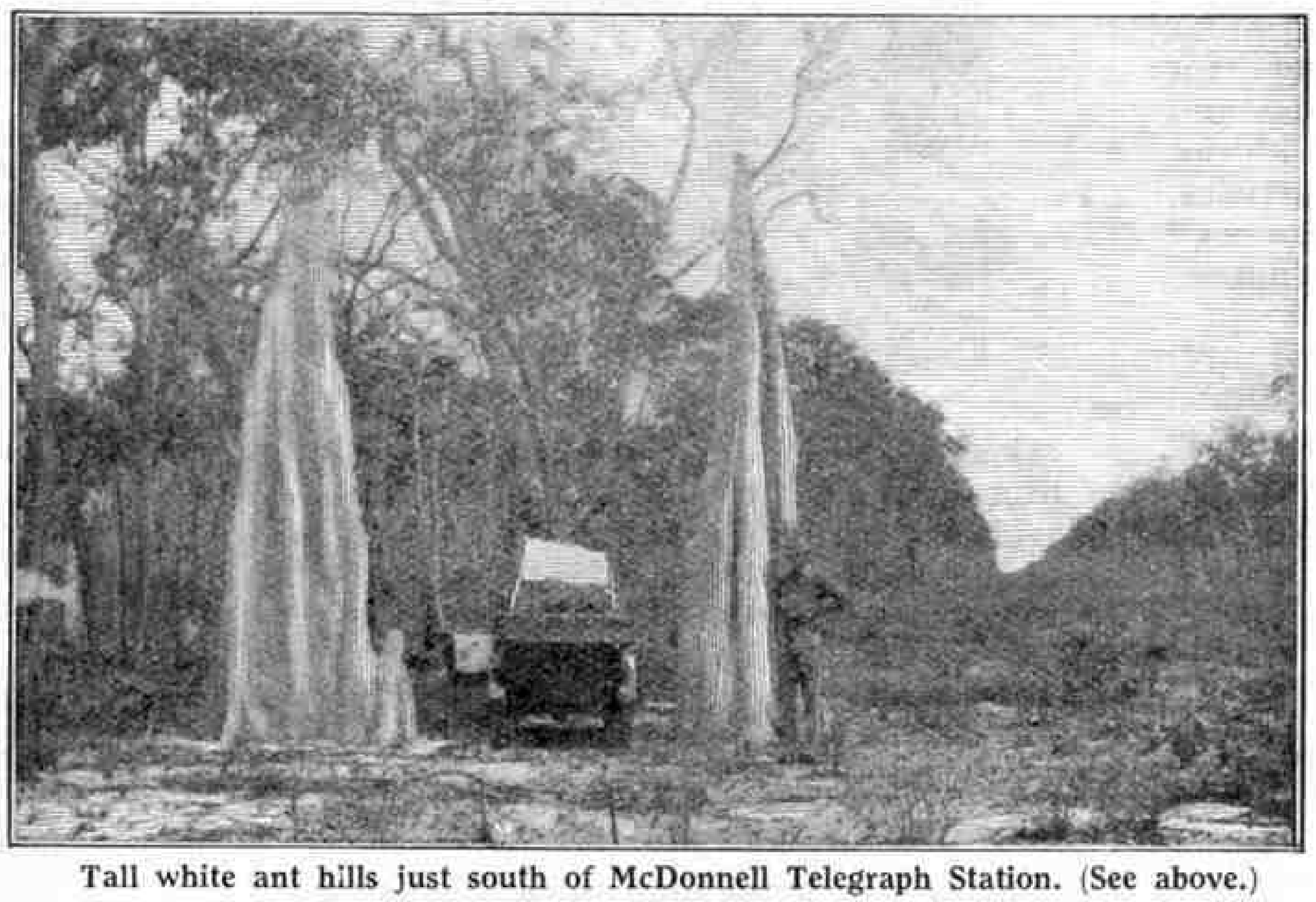
The car bogged near the Dulhunty River. (From "Little Wheels" reviewed on this page.)

"Knots, Splices and Fancy Work"

By C. L. Spencer

(Brown, Son & Ferguson. 5/- net)

It is interesting to find that a second edition of this excellent book has been called for. The age of sail has left in its passing many fine and beautiful arts, and among these a high place is taken by the art of knotting and fancy rope work. The author's object in writing this book has been to make an effort to preserve this fast dying art, and it is apparent that to some extent, at any rate, his efforts have succeeded. The book contains more than 200 examples of knots, splices and fancy work of various kinds, and much of the material is not to be found elsewhere. The descriptions are clear and easy to follow, and the illustrations, of which there are over 260, are well drawn and excellent for their purpose.



Tall white ant hills just south of McDonnell Telegraph Station. (See above.)

"Vanishing Wilderness"

By La Monte and Welch

(Harrap. 7/6 net)

The authors are distinguished members of the staff of the American Museum of Natural History, and the book combines information about the lives of wild animals with the exploits of adventurous men. In all too short a time the wild animal roaming freely in the open wilderness may be a thing of the past.

We are told of "Grizzly" Adams and his troupe of unchained grizzly bears walking through the streets of San Francisco in the days of the Gold Rush; of the herds of shaggy bison; of reindeer, the living counterpart of those Santa Claus reindeer that go prancing over chimney tops delivering presents; of the excitement in Siam when a white elephant is discovered; of the camel's service to man throughout history. This is a very delightful animal book, illustrated by appropriate drawings.

"Brave Men All"

By Vice-Admiral G. Campbell

(Hodder and Stoughton. 7/6 net)

This is a record of the heroic deeds of men who "go down to the sea in ships." The author reminds us in his preface that "the sea is our heritage," and although some of the stories have been told before, he declares that "they cannot be too often retold, especially when one sets out, as I have done, to give examples of the heroism which takes place on the sea during the piping days of peace."

He could not have done better than begin by recounting the familiar story of how Grace Darling and her father, the keeper of the Longstone Lighthouse, on Farne Island, one morning braved mountainous seas to rescue the survivors of the "*Forfarshire*," wrecked on the rocks during the previous night.

In writing a book of this kind some sort of classification is essential, and the author has grouped the heroic deeds he relates under such headings as "Life-boats," "Fishermen," "Open Boats," "Men-of-war to the Rescue," and so on. The stories that make up each chapter vary in circumstance of course, but they are alike in bearing testimony to the high standard of conduct which for centuries has permeated the spirit of those who spend the greater part of their life at sea.

The book contains many fine illustrations, and the index includes the names of the men, ships and places mentioned in the text.

"Joc and Colette at the Natural History Museum" By Vera Barclay

"English Wild Animals"

By J. Fairfax-Blakeborough

"Magic in the Woods"

By G. H. Browning

(Burns Oates. 3/6 each net)

In "*Joc and Colette at the Natural History Museum*" we meet once more Colette, whom we last saw at the seaside with her old friend Joc. She is now on a visit to Joc's home in London, and bubbling over with enthusiasm at the wonders of the Natural History Museum. The interest these young folks display is certainly infectious, and those who have the bad luck to be unable to visit the Museum will almost feel that they have actually seen it through the eyes of Joc and Colette. The book is well illustrated with charming drawings by Joanna Duby.

Major Fairfax-Blakeborough knows the countryside so well that anything he writes concerning it can scarcely fail to be interesting. In this volume he deals with wild animals, and he has produced a book packed with really absorbing information about the lives and habits of the fox, the badger, the hare, the squirrel, the otter and other inhabitants of the woodland. The stories he tells of incidents in the lives of these creatures are full of interest, and at the same time one feels that the author, unlike some writers on animals, really knows the creatures, and is writing about things he has seen for himself. The excellent illustrations are by Doris Fairfax-Blakeborough.

"*Magic in the Woods*" is described on the title page as "a story book of trees," and it fulfils the description perfectly. It does not deal with the trees merely as what one might call large vegetables, but describes them as real individuals, each with a life and character of its own. Along with expert information regarding the growth, flower, leaf and fruit of all the principal English trees, are entertaining stories and legends that have grown up around the trees during the centuries, and still persist, one is glad to say, in spite of all the scientific knowledge of today. This is a delightful book either to read at home or to slip into one's pocket on setting out for a walk through the woods. The fine illustrations, many of which are in colour, are from photographs by Capt. R. St. Barbe Baker.

"Rhodesian Rancher"

By Wilfred Robertson

(Blackie. 5/- net)

The name of the author of this interesting book is familiar to readers of the "*M.M.*," as several articles from his pen have appeared in its pages. "*Rhodesian Rancher*" is an account of Mr. Robertson's life as a settler in Southern Rhodesia. He begins by telling how he bought a piece of land, "twenty-seven square miles of virgin bush," and with the aid of a few natives cleared a small area of it and built there three wooden huts—a living room, a bedroom and a store. By steady labour all the bush was cleared, and in time the ranch prospered. The author's adventures included fights with forest fires and encounters with big game.

New Books for Christmas

Annuals
(R.T.S.)

The 57th volume of *"The Boy's Own Annual"* (12/6 net) is as rich in good things as any of the previous issues. The stories, both long and short, are by well-known writers and are full of exciting incidents. The general articles are as good as ever, and cover a wide range. They include several new series, which deal with Careers; the lives of famous men who have risen from humble circumstances to affluence; types of Dogs; principles of Cricket, and other topics. There are splendid coloured plates and many black-and-white illustrations.

The second volume of *"The New Empire Annual"* (7/6 net) is compiled on similar lines to its predecessor, and caters for young readers both in the Homeland and the Dominions and Colonies. The stories are excellent, and the general articles, which are of a high class and are well illustrated by photographs, give glimpses of life in far-off parts of the Empire.

"The School Boy's Annual" (3/6 net) is not, as the title rather suggests, confined to stories of school life, but contains also many exciting adventure yarns. The stories are illustrated by numerous black-and-white drawings.

Stories by Major Charles Gilson
(R.T.S.)

Major Gilson's name has long been a guarantee of a rattling good adventure yarn, and in the five books reviewed below he maintains his reputation in this respect.

"The Mystery of Ah Jim" (2/6 net) is a story of the Chinese underworld in the days when there were opium dens in the poorer parts of London, and of piracy in Eastern seas. Ah Jim is a kidnapped English boy brought up by a Chinaman in Deptford, and the story describes his exciting voyage on board a pirate ship. *"The Scarlet Hand"* (2/6 net) relates the extraordinary adventures of two schoolboys who fall into the hands of the Chinese Secret Society of the Scarlet Hand. In complete contrast to these two books, *"The Realm of the Wizard King"* (2/6 net) deals with the perils encountered by an expedition to the Belgian Congo in search of a huge reptile believed to be a survivor of a prehistoric race.

"The Fire Gods" (2/6 net) is another tale of the Congo and also deals with the adventures of an expedition to that region. In *"The Silver Shoe"* (2/6 net), Major Gilson returns to China as the scene of his story, and tells how three Englishmen, one a boy, succeed in overthrowing the Secret Society of the Silver Shoe, a powerful organisation formed to destroy all "foreigners" in China.

Each book has an excellent frontispiece and the two last-mentioned have additional full-page plates.

Stories by Robert Harding
(R.T.S.)

Robert Harding is by now well known as a writer of excellent adventure books, and *"Dallenger of the Police"* (2/6 net) is one of his best. Dallenger is a courageous Secret Service Agent attached to the Military Police in India, and seven of his amazing exploits are told in this book. *"Stirring Tales of Yore"* (2/- net) is a departure from the author's usual kind of book. In it he has taken 12 of the most adventurous tales of literature and re-written them in a vivid style suitable for boys. *"Pioneer Jack"* (2/6 net) is a yarn of the desolate Syrian Desert, where Jack and his brother have an exciting time searching for hidden treasure. There are three other equally good stories in the book.

"Treacherous Waters"
By Alec Lumsden. (R.T.S. 2/6 net)

Stories of smuggling always make good reading. In this book John and his cousin David are spending a holiday in a quiet fishing village, but life becomes very exciting after they discover the activities of smugglers in the neighbourhood.

"What Pamela Saw in Japan"
By A. S. Roe. (R.T.S. 2/- net)

This delightful fairy tale for children describes the many unexpected things that happened to Pamela in Japan. Sometimes it was a really big adventure, as when she was nearly drowned in an ice cave, and at other times very quaint and funny things befell her.

SCHOOL STORIES

"The Mystery of Cranston School"
By Michael Poole

"Six Tough Fellows"
By Anton Lind

(Sampson Low. 2/6 each)

The solving of *"The Mystery of Cranston School"* begins when Tony Blair of the Fourth Form accidentally finds the first clue. He becomes one of a small band of amateur detectives who, in trying to unravel the mystery, become involved in a series of startling events. *"Six Tough Fellows"* chiefly concerns a foreign boy at Altonbury School, and a trio of fellows who make a vow to protect him from Clack, a Fifth Former who dislikes him. In spite of feuds and other exciting happenings the story ends happily.

AIR STORIES

"Air Pirates of the Congo"
By G. G. Jackson

"The Crimson Caterpillar"
By Sercombe Griffin

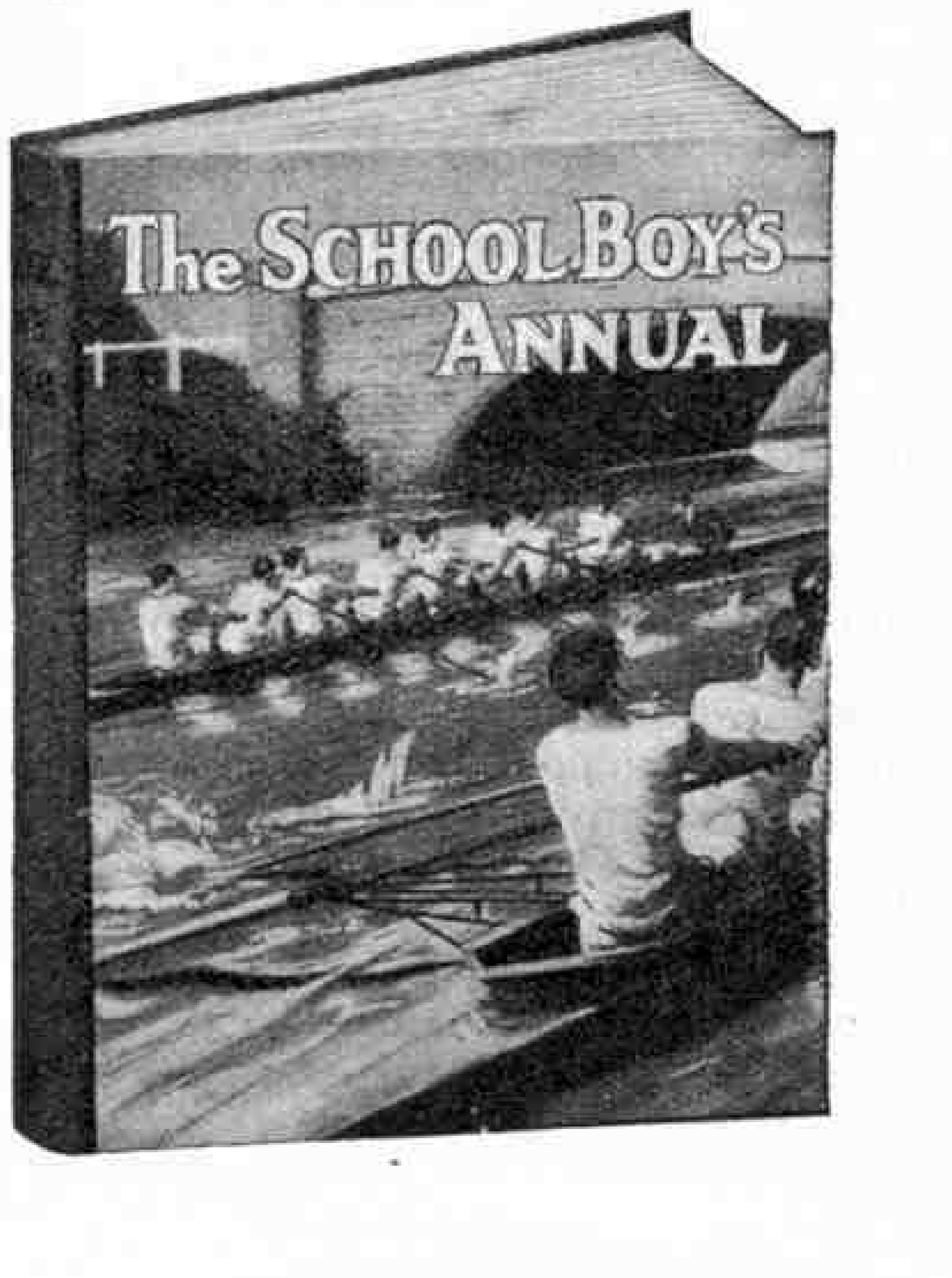
"The Air Circus"
By Jack Heming

(Sampson Low. 2/6 each)

A search for rubies in the Congo by two boys in a seaplane forms the plot of *"Air Pirates of the Congo."* They are captured by the Air Pirates, a gang of villains, but succeed in making a thrilling escape. *"The Crimson Caterpillar"* is the name of a remarkable aeroplane invented by a French boy named Henri, in which he and a chum set out to fly across the Sahara and discover the City beneath the Sand. The adventures of *"The Air Circus,"* a formation of skilled pilots, occur during a tour intended to show foreign experts that British aircraft are the best in the world. A foreign Power, determined to "stick at nothing" to bring about the downfall of the Circus, introduces complications, and some desperate situations develop.

"At the Sign of the Wolf's Head"
By Bernard Masters. (Sampson Low. 2/6)

Here is a bold buccaneering yarn of the Spanish Main, telling how Roger Dale, an intrepid youngster, and his friends, outwit a notorious buccaneer, whose activities are carried on under the sign of a wolf's head.



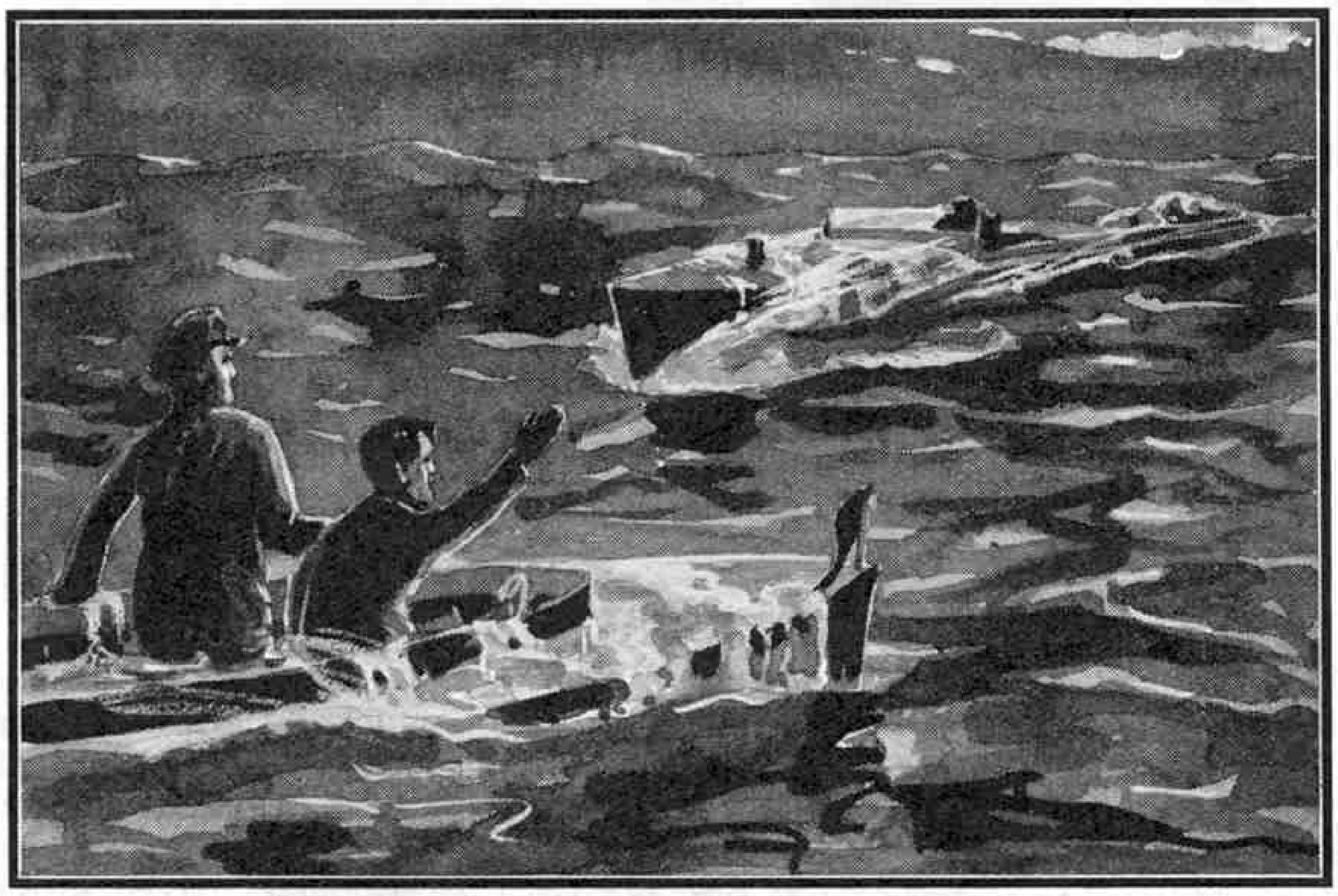
The Speed Boat Passenger

A Curious Seaside Ghost Story

By L. C. Pudney

I HAD been working late that day giving visitors thrills in my red speed boat *"Gee-Whiz,"* and had been busy until the chill of evening had caused the public to desert the beach where my landing stage was situated. However, I could not take the boat back to the moorings for an hour or so, as the tide was too low in the harbour channel, and I did not want to damage my "prop" on the bottom. So sending my assistants home, I settled down to wait as patiently as possible.

By the time I judged the tide would be about right it was almost dark, and I was preparing to depart when I noticed a figure approaching across the beach in the gathering gloom. The figure came along the landing stage, and I saw that it was an old man, tall, with a grey beard, and dressed in a smart but sombre-coloured suit. Something about him suggested to me that he was a retired skipper, and I wondered what he wanted. For a second or two he looked at my boat in silence, and then he turned to me and spoke: "Can you run me out to my ship, the *'Alvania,'* I'm in a great hurry, and a speed boat should get me over in ten minutes."



"I circled round a small motor boat that was rapidly sinking."

I did not know of such a ship, but somehow I never thought of asking questions. I simply nodded, and gave him my hand to assist him into the boat, but he ignored it and stepped into the "after cockpit," as the back seat is called. I looked doubtfully at the old gentleman. "You will get rather wet in that seat," I said, but he snapped the single word, "Hurry!" So I let the matter drop, and tossing an oilskin to him prepared to depart. I started the motor and shot away into the darkness; the old gentleman was to give me a shout when we neared the *"Alvania."*

The tide was now rising strongly, and coming up against the wind was making the sea very choppy. Spray shot in clouds over the after cockpit and I was getting very wet myself, although I crouched beneath the windscreen as much as possible whenever my navigation lights revealed the bows plunging through a big wave. I was beginning to wonder whether it would be advisable to turn for shelter, as it is very unpleasant in a speed boat when "white horses" are about. Still, I thought, the *"Alvania"* should be close at hand now, although I could not see it. I turned to see how my passenger was enjoying his voyage, but he had covered himself entirely with the oilskin and was hidden from view beneath the protective covering.

Once more I gave my attention to the wheel, endeavouring to "cushion" *"Gee-Whiz"* over the waves, which now threatened to break her back as she dashed through the tossing waters in a smother of foam. Suddenly my eye caught something in the water a little distance to port and instinctively I turned towards it. A voice hailed me urgently; and I circled round a small motor boat that was rapidly sinking. She was filling with every wave that broke over her, and although the occupants, two young men, were baling frantically, they were fighting a losing battle. A few seconds after they had scrambled into *"Gee-Whiz"* a broken wave dashed towards us and the motor boat vanished.

My new passengers were two visitors who, setting out for a trip, had broken a piston and were drifting helplessly when the sea grew rough.

I was now anxious to return to the landing stage—if I could reach it! There was a good prospect of getting swamped if I could not keep the bows up, and the alternative of smashing a plank if I continued at "planing" speed. An awkward situation! "I can't make your ship now!" I shouted at the occupant of the after cockpit. There was no reply from beneath the oilskin, but as no reply was actually necessary, I did not pay much attention and settled down for a wet trip back to the stage.

I succeeded in getting alongside safely, and after making fast I helped the "ship-wrecked" visitors ashore. "I hope you will be alright now," I said. They held out their hands in token of thanks. "This is quite a family coincidence," said one of them, with a faint smile. "Fifty years ago to-day my grandfather's boat was lost with all hands in these waters, and we nearly suffered the same fate."

I looked at him with interest, and then, with an uncanny feeling creeping over me, I said: "What was the name of your grandfather's ship?" He looked surprised at my excitement, and replied: "The *'Alvania.'* Why?"

I did not answer, but dashing across to the boat, lifted the oilskin that should have been covering the old man.

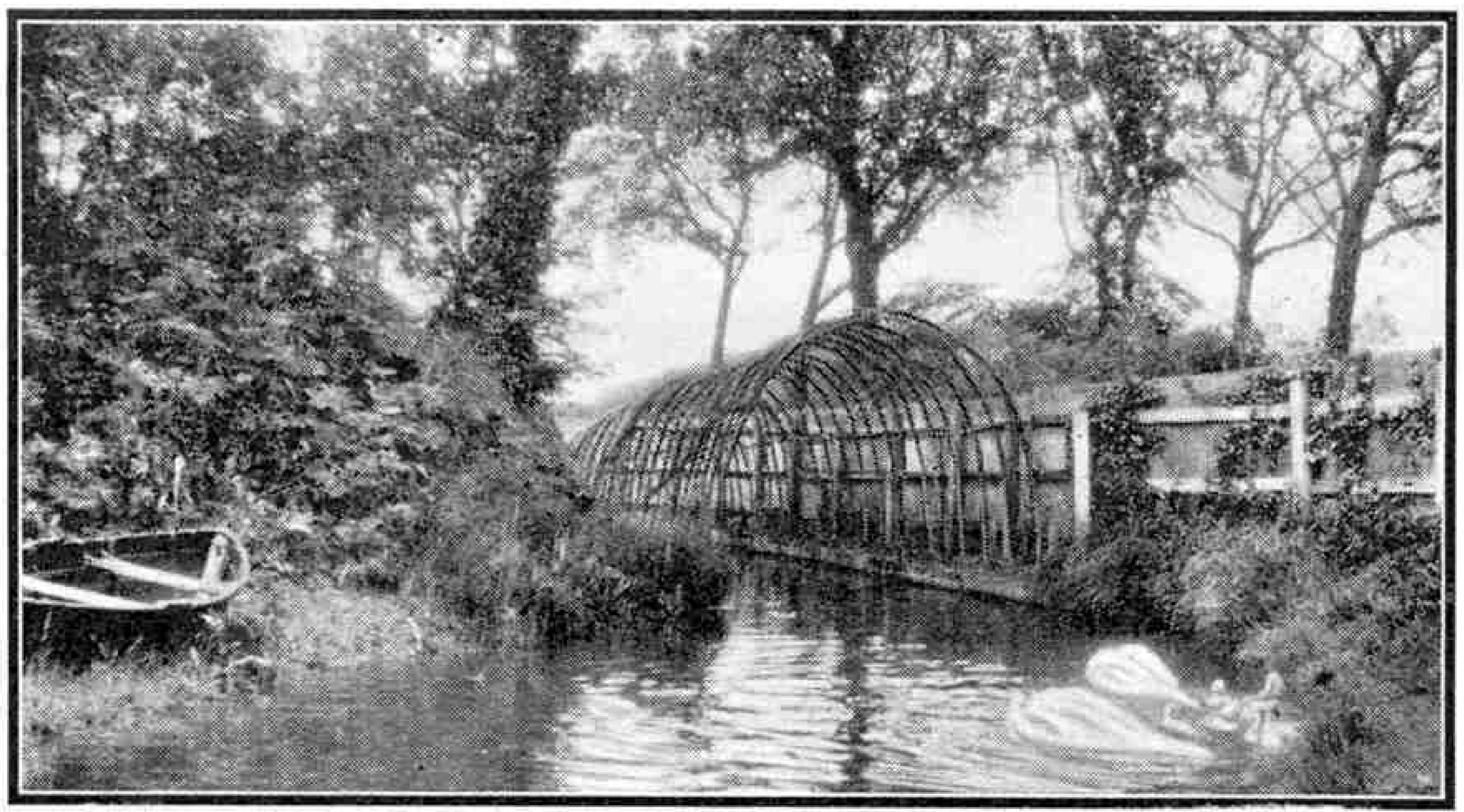
The after cockpit was empty!

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

The Swannery at Abbotsbury

The famous Swannery at Abbotsbury has come into prominence recently, as an R.A.F. armament training camp is being established only four miles away, and it is feared that the swans will be seriously disturbed, and even endangered, by the bombing practices. The Air Ministry say that if this proves to be the case they will move the targets much farther away and, if necessary, out to sea.



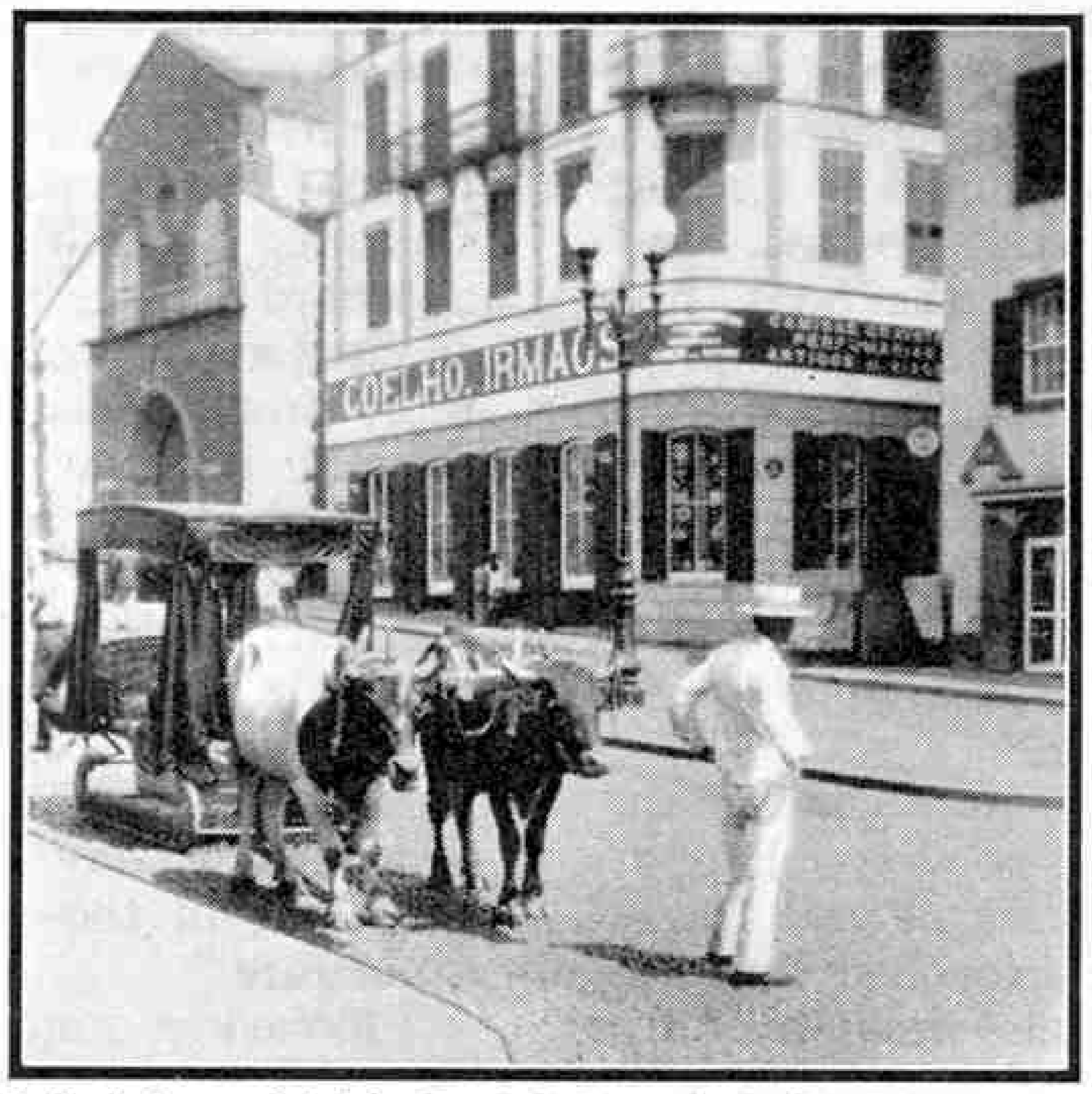
A duck decoy at the famous Swannery at Abbotsbury. Photograph by J. D. U. Ward, Oxford.

The Swannery is known to be at least 500 years old, and probably dates back to the 12th century. It is the largest in the world. The number of swans there has sometimes been 1,500, and is never less than 500. An interesting part of the Swannery is the duck decoy shown in the accompanying photograph. This decoy is still worked occasionally in the winter, and the photograph shows the end of one pipe to the mouth of which wild fowl are decoyed by tame ducks fed on the spot. Once inside the pipe the fowl are driven up to the far end, where the net narrows and terminates in a large "purse" flat on the ground.

Formerly there were several hundred duck decoys in this country, but there are now less than six in working order.

Abbotsbury is also the scene of a very fine 15th century tithe barn. Half of the building is in ruins, but the other half is sound and in use. Near the barn are several depressions that mark the site of the old monastic stews or stewponds, in which the monks used to put fish, that they had reared in an adjacent fishpond, to fatten.

J. D. U. Ward (Oxford).



Bullock-drawn sleigh in Funchal, the capital of Madeira. Photograph by C. C. Brigstocke, Etchingham.

The Capital of Madeira

Madeira, a Portuguese island 350 miles from the coast of Morocco, has much to interest tourists, and particularly those who like beautiful scenery. I know one can see beauty in almost every country of the world, but I think Funchal, Madeira, must be unique among the capitals of the Earth. It is a large town for such a small island, as although the area of Madeira is only 300 square miles, Funchal has a population of over 23,000. It is the chief port of the island.

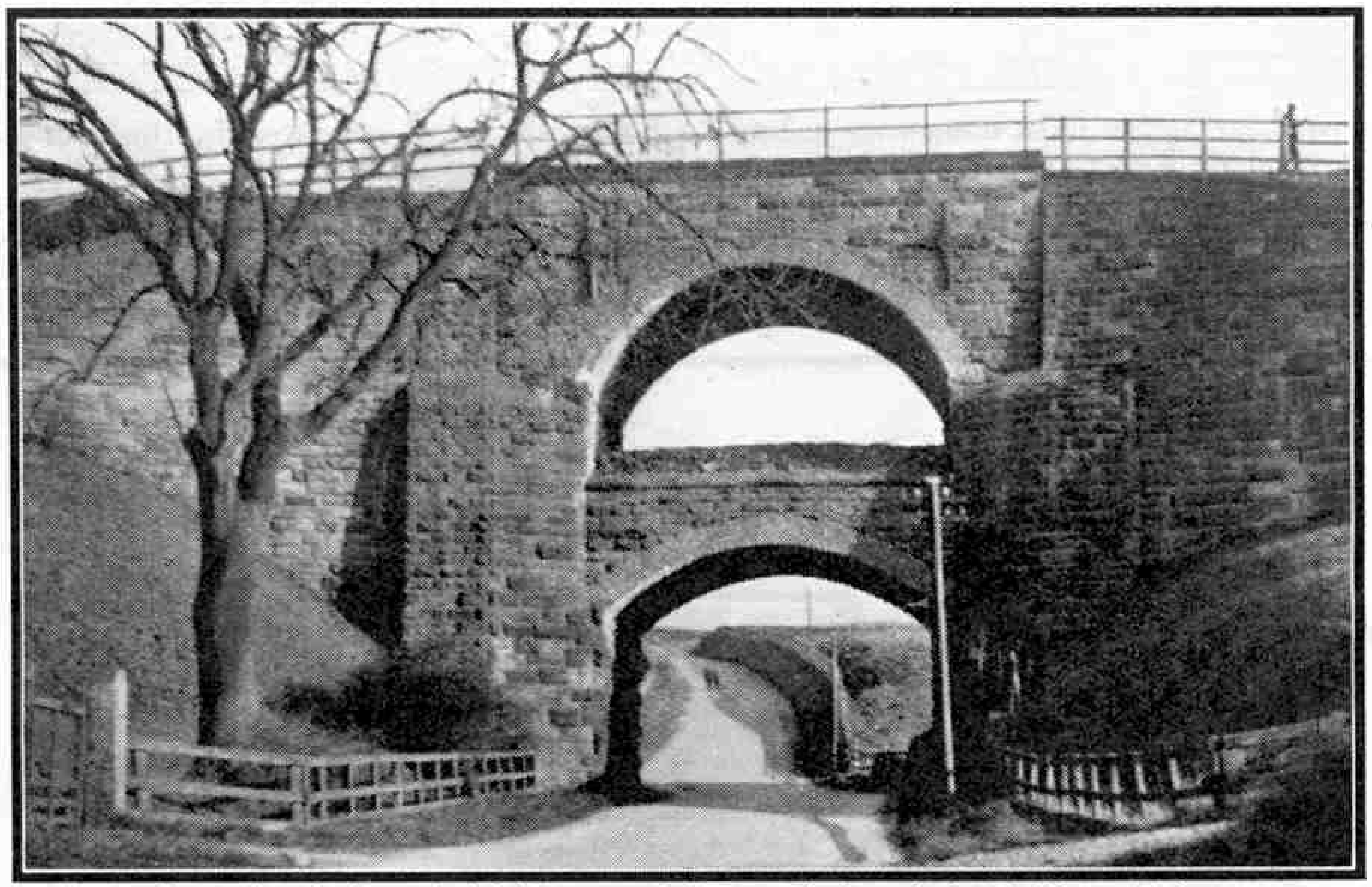
We were met on the quay by flower-girls in picturesque costume. This costume is not usually worn, however, and is only to attract visitors. The first thing I noticed in Funchal was that the streets are paved with cobblestones set tightly together. On account of this, sledges drawn by bullocks are used to transport both goods and people. The sledges are most comfortable, although inclined to skid when going round corners. There are taxis and omnibuses, however, for people who wish to travel more speedily, but after a ride in a taxi we wished we had chosen a bullock cart, as we had some very narrow escapes from accident.

Funchal is quite a modern town, and has two good hotels and a really fine open-air swimming bath on the seashore. The changing rooms are hollowed out of the rock at the back of the bath, and there are fresh-water showers and other modern amenities. All the shops accept English money, and many of the inhabitants speak English. The Portuguese are the most friendly and polite foreigners I have ever met, and I look forward to visiting Funchal again.

C. C. Brigstocke (Etchingham).

Two Bridges as One

About four miles from Saltburn there is the interesting double-arched bridge illustrated on this page. It is really two bridges, the one upon the other, as the arches were built at different times. Originally it consisted only of the lower arch, which was built about 1870 entirely of sandstone obtained from quarries in the district. A good idea of the appearance of the bridge then can be obtained by visualising a solid wall where the upper arch now is, and the buttresses on each side cut away so that their faces are flush with the stonework of the lower arch.


Interesting double-arched bridge near Saltburn. Photograph by T. Vivers, Redcar.

In October 1882 a terrific north-west gale split the masonry near the centre, from the top almost down to the arch. This damaged portion was pulled down, and stout buttresses were built at both sides. In place of the sandstone wall an upper arch was built on top of the sound portion of the original structure, thus forming a double arch to allow the wind to pass through without battering the bridge. The height from the centre of the road to the crown of the lower arch is about 20 ft., and to the top of the structure about 50 ft. The bridge carries the L.N.E.R. branch line to Whitby Road.

A curious thing in connection with the bridge is that if a person is walking along the road with the wind behind him he discovers, when under the bridge, that the direction of the wind has reversed. This is due to the bridge being in a valley, and as the wind passes through the upper arch, the air on the other side acts as a cushion and returns the wind through the lower arch. T. Vivers (Redcar).

At Baghdad Airport

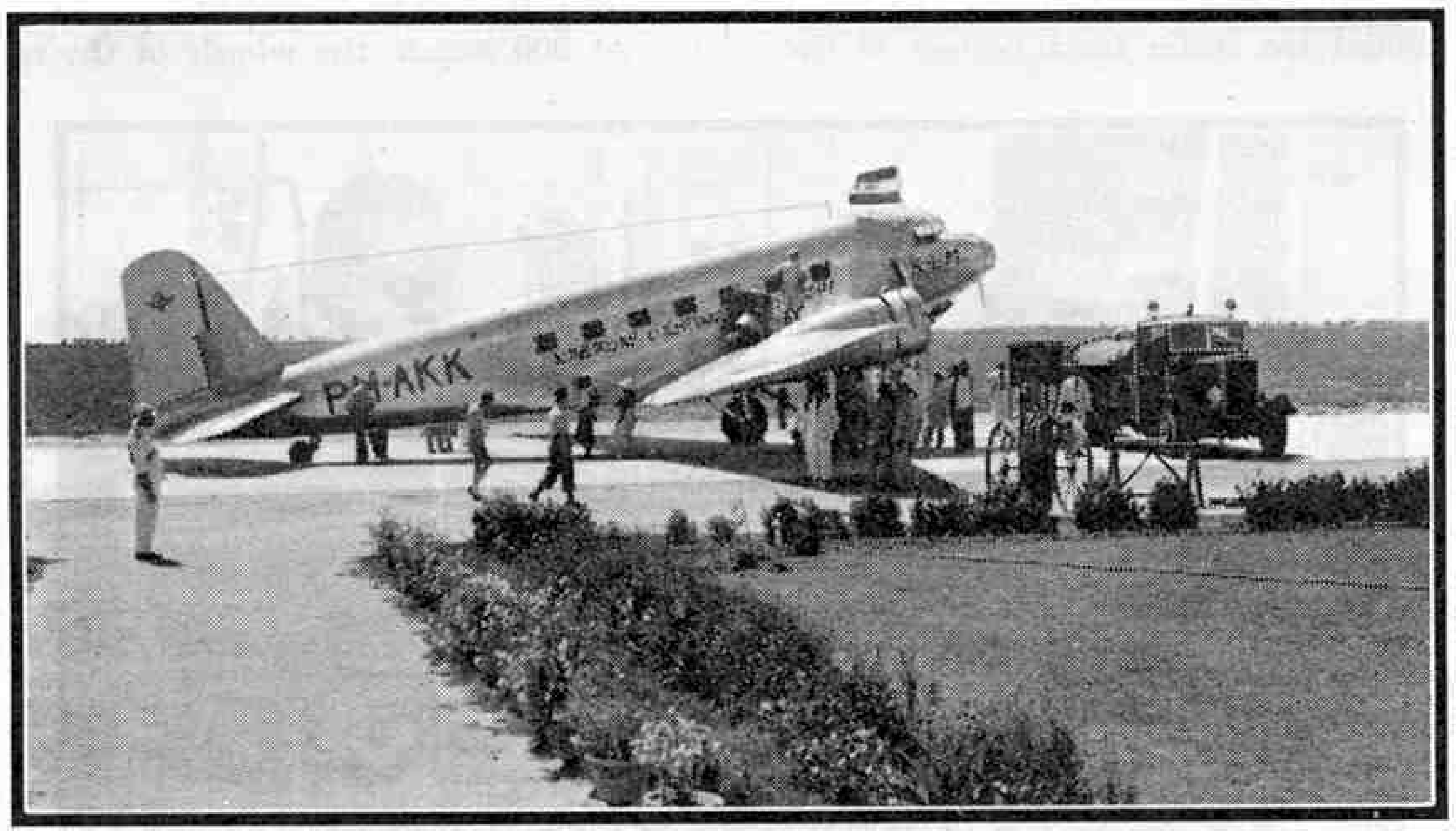
My father received an official invitation to photograph the arrival at Baghdad Airport of the first Douglas D.C.2 aeroplane to be employed on the K.L.M. service between Amsterdam and Batavia, via London and Baghdad. I was delighted to be able to accompany him. When we reached the airport we found an impressive gathering of Iraqui Ministers, British officials and other notables eagerly awaiting the arrival of the machine, and frequently scanning the sky for sight of it. I felt lost in the great crowd of spectators.

The machine was due to arrive at 1 p.m., but it was not until half-an-hour later that its approach was announced through the loudspeakers at the airport. All eyes were again turned to the sky, and a black spot on the distant horizon was seen to be rapidly approaching and growing in size. Soon one of the most wonderful aeroplanes I have ever seen was circling above us, and amid the loud cheers of the spectators it made a perfect landing. There was a rush towards it, and I was able to get near enough to see the passengers and crew disembark. They all looked healthy and not in the least tired. The Douglas D.C.2 had covered the journey from London to Baghdad in the record time of two days, flying only 9 hrs. of each day.

After a time the crowd dispersed, and it was then possible to inspect the machine in comfort and to take the photographs, one of which is reproduced on this page. This type of aeroplane was described in the September 1935 "*M.M.*"

Baghdad airport was completed in April 1933 at a cost of £17,000, and was opened by the late King Faisal. It is interesting to recall that it was the first of the official checking points of the MacRobertson Air Races last year.

A. J. Kouyoumjian (Baghdad).



The first Douglas D.C.2 aeroplane used on the K.L.M. service to Batavia at Baghdad Airport. Photograph by A. J. Kouyoumjian, Baghdad.

"Shooting the Breakers"

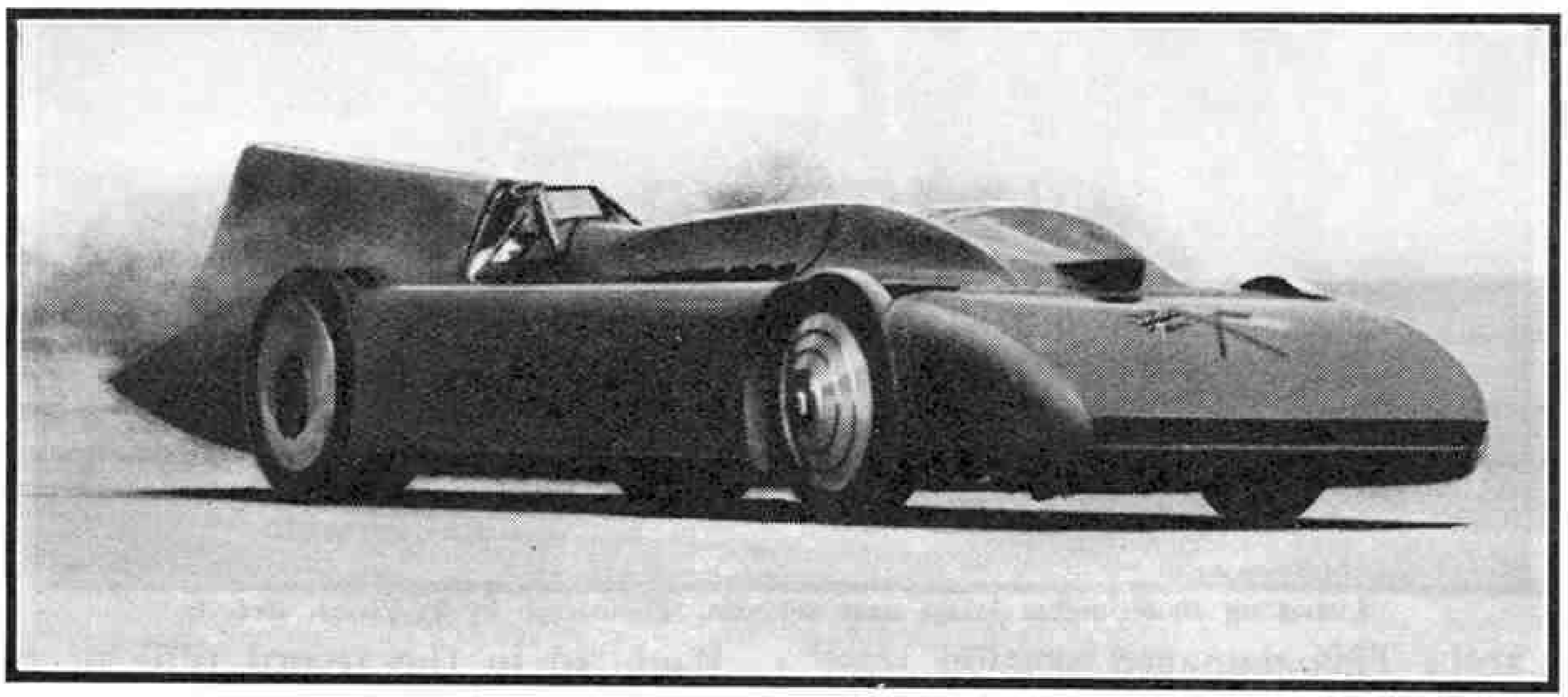
A thrilling and popular sport of the swimmers who throng the surfing beaches of New South Wales at summer weekends is "shooting the breakers." I shall always remember my first "shoot." I had practiced during the three previous summers. On this occasion I waded seaward, with others, until a big wave was almost upon me. At the right moment I turned and swam quickly toward the shore. The wave broke and swept me upward. Amid a smother of foam I shot down the face of the wave at great speed, then "flattened out" on to an even keel, and landed on the shore. It is even more exciting on a surf board. This is a long, specially shaped board on which one lies, and using the hands as paddles, shoots through the breakers. G. Brown (Bexley).

Heat as an Enemy of Speed

The Part Played by Lubrication

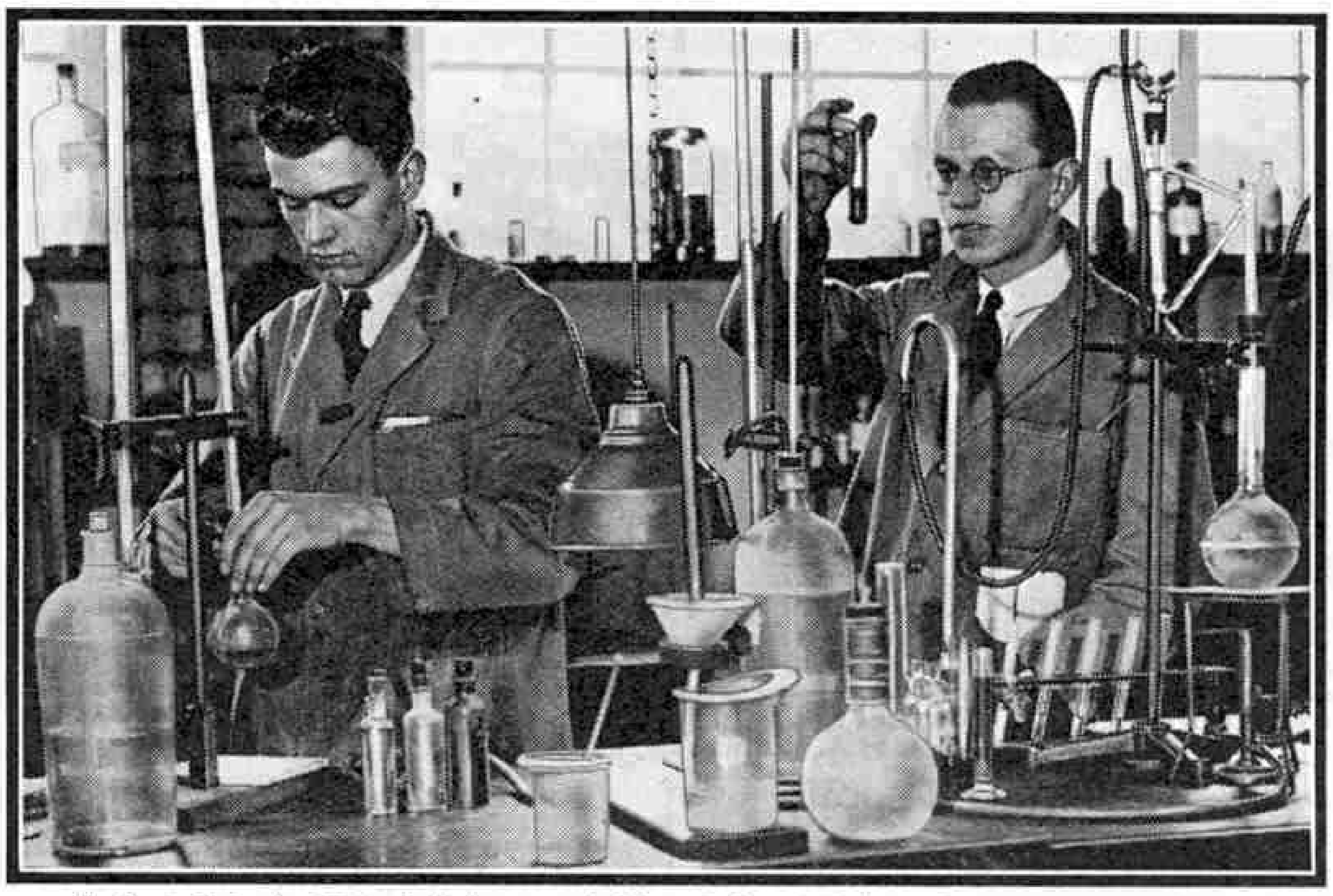
EVERY racing man regards heat as the most dangerous enemy of speed. It is true that wind resistance is a close competitor, but with the difference that wind resistance merely retards speed, without undermining the vitals of a car; and it can be largely overcome by effective streamlining. Unchecked heat, on the other hand, will cause retirement in a race through big end trouble.

In view of Sir Malcolm Campbell's brilliant achievement in achieving, at Salt Lake City, his heart's desire of a world's land speed record of 300 m.p.h. some details of the heat generated by the giant engine of *"Blue Bird,"* and the means adopted to provide efficient cooling, will be of interest. Although no actual figures for the last attempt are yet available, the designer of the car, Mr. R. A. Railton, has disclosed some interesting facts with regard to the previous model.



"Blue Bird" at speed at Salt Beds, Utah, U.S.A., where Sir Malcolm Campbell set up the world's record of 301 m.p.h. The illustrations to this article are by courtesy of C. C. Wakefield and Company Ltd.

The question of the cooling system to be employed was considered before anything else in designing the car for the attempt, even to the extent of avoiding the air resistance of a radiator by employing some system of internal cooling. In the end it was decided to use an enclosed honeycomb radiator with a slot for the air to enter. In deciding on the size of this unit, due consideration was given to the fact that it was only necessary for it to be sufficiently large to prevent the water from boiling at the end of two runs. A margin of error had to be allowed, providing for sufficient excess water to allow of about 60 seconds' boiling without risk of the jackets running dry. In 1932 the radiator size was considerably reduced, and the maximum temperature of the water rose from 140 degrees F. to about 176 degrees F. It was found that the size could be reduced by a further 10 per cent. without risk of any appreciable boiling. In the engine fitted to the 1933 model the area of the radiator was 434 sq. in., and the approximate heat transferred to cooling water under full load was 48,000 B.Th.U. per minute (test bench figures).



Testing oil in the Wakefield Company's laboratories at their works at Hayes, Middlesex.

So much for the external water cooling of the engine. Now we come to lubrication, of vital importance in every racing car, but tremendously important in a car that is to travel at the terrific speed of 300 m.p.h. The constant supply to the engine of oil, and exactly the right type of oil, is as necessary as the blood stream from the heart in the human body, the heart in this case being the oil pump.

Some idea of the enormous heat generated in the engine of the latest five-ton *"Blue Bird"* may be gathered from the fact that it develops approximately 2,500 b.h.p., with an estimated engine speed of 3,200 r.p.m. at 300 m.p.h. There is to be considered also the heat generated in the gear-box. This means that the best quality oil must be used to act as a buffer between moving parts of the engine to prevent friction, to carry away the immense heat generated, and to protect the engine, and particularly the cylinders, from the effects of corrosion and the formation of sludge.

Basically the same considerations in relation to heat apply to ordinary road racing, except that everything is on a lower scale, and with the important difference that greater endurance is imposed upon the wearing parts over a longer period. It might be supposed that for racing, and particularly for attacks on world records, special lubricating oils would be necessary. In point of fact the Patent Castrol used in *"Blue Bird"* was exactly the same as the oil sold at any wayside garage.

Tyres also are liable to suffer from the combined effects of heat, abrasion and centrifugal force. The enormous friction will wear off the tread in a single run in attempts upon a world record. If one of the outer layers of the cord had been cut when *"Blue Bird"* was travelling at 300 m.p.h., the centrifugal loading on the broken ends would have caused them to fly out radially, tearing the rubber tread like paper.

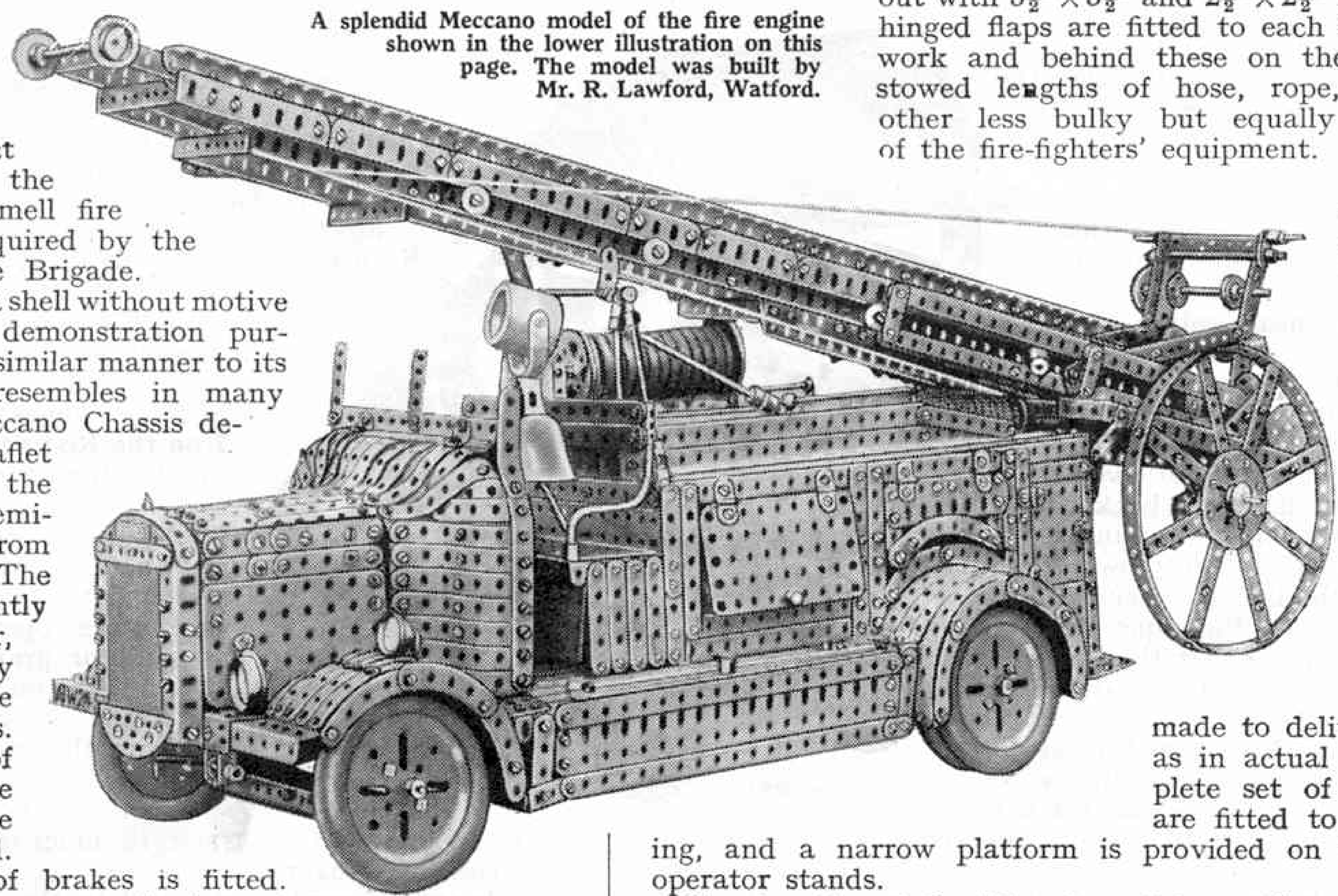
At 300 m.p.h. the wheels of the car revolve about 2,640 times per minute; which means that every part of each tyre is struck 44 times per second with a blow equal to its share of the weight of the car. This corresponds to a blow of 18 cwt. on each front tyre and nearly 17 cwt. on each of the four rear tyres (twin wheels). Added to this is any impact force brought into play by wheel-bounce or other phenomena due to irregularities of the track.

In tests on a high-speed test machine that had no artificial cooling draught, the tyre temperature rose about 72 degrees F. per minute at 300 m.p.h. This very rapid rate of heating is not approached on the car in actual running, owing to the very much greater cooling; but the figure indicates the importance of this factor.

The triumph of breaking a record or winning a race is, in fact, a triumph of science, engineering and pit work, as well as of driving skill. The laurel wreath given to the winner of a race might very well be distributed leaf by leaf among all those who had a part in building or preparing the car. Many leaves should go to the research chemists, metallurgists, and others who work behind the scenes. In addition there are the officials who prepare and guard the course on which the record is made, and those who time the run.

Meccano Fire Engine with Real Pumps

Escape Nearly Eight Feet Long



A splendid Meccano model of the fire engine shown in the lower illustration on this page. The model was built by Mr. R. Lawford, Watford.

A FIRE engine offers excellent scope for the ingenuity of the model-builder, and many interesting models of this kind have been described in the model-building pages of the "*M.M.*" and in the Meccano Manuals. The splendid miniature fire engine illustrated on this page undoubtedly is the best of its type yet built. It was constructed by Mr. R. Lawford, Watford, and is an almost perfect scale reproduction of the "*Silver Jubilee,*" a Scammell fire engine that has been acquired by the Borough of Watford Fire Brigade.

The model is not merely a shell without motive power, suitable only for demonstration purposes, but is built up in a similar manner to its prototype. The chassis resembles in many respects the standard Meccano Chassis described in Instruction Leaflet No. 1a, and is fitted at the front and the rear with semi-elliptic springs built up from Strips of varying lengths. The steering mechanism is a slightly modified Ackermann gear, and the front axle is very strongly built from Angle Girders and Curved Strips.

The differential is of orthodox design, but the method of securing the brake discs is improved. A very interesting set of brakes is fitted. These are operated by compressed air and controlled by means of a hand lever and a foot pedal. The front wheels are provided with a similar braking arrangement. It will be noticed that twin tyres are used on the rear wheels.

From a constructional point of view, the outswept sides and top of the inner end of the bonnet constitute the most difficult part of the bodywork. In the model Strips of varying lengths have been used. These have been very carefully bent to the required shape and then bolted at their rear ends to a curved set of Strips representing the front frame of the dash board.

The top of the bonnet is built up from 4" Strips, each of which is formed from two 2½" Strips overlapping two holes, and its sides are provided with two Meccano Hinges. It forms a cover for the 250-volt electric motor by means of which the model is driven. The radiator is similar to that of the Motor Chassis described in Leaflet No. 1a, but a small sheet of perforated zinc has been used to represent the radiator tubes, and has been slightly corrugated in order to give a more realistic appearance. A fan, driven from the electric motor, rotates behind the zinc, the bearing for the fan shaft being secured to the inside of the bonnet.

The Scammell fire engine of the Borough of Watford Fire Brigade. The model shown above is a faithful reproduction of this engine.

The gear-box casing is integral with the electric motor supports, and the gears available are three forward and one reverse. The gear ratios of the three forward speeds are 3 : 1, 2 : 1 and 1 : 1, and that of the reverse gear is 3 : 1. A clutch also is incorporated, and this is similar to that fitted to most Meccano motor chassis models.

The bodywork of the model reproduces admirably the impression of bulk and power typical of all modern fire engines. Strips are used to a large extent in its construction, and Angle Girders of various sizes are used to represent the recessed portion at the top. In actual practice this forms a seat for the firemen. The building of the pump housing at the rear of the model is carried out with 5½" × 3½" and 2½" × 2½" Flat Plates. Three hinged flaps are fitted to each side of the bodywork and behind these on the real engine are stowed lengths of hose, rope, respirators and other less bulky but equally necessary items of the fire-fighters' equipment.

Undoubtedly the most remarkable feature of this model is the real working pumping equipment incorporated in it. This pump is driven separately from the main electric motor, and the hoses, when coupled up, can be made to deliver water exactly as in actual practice. A complete set of dummy controls are fitted to the pump housing, and a narrow platform is provided on which the pump operator stands.

The lengths of flexible pipe of large diameter that connect the pumps and hydrant are carried on top of the body, and a hose reel of large capacity also is mounted, and carries narrow rubber tubing wound on it to represent the hose itself.

The fire escape is a perfect miniature reproduction of one of the most modern units of this type, and when fully extended it reaches to a height of nearly eight feet. It is constructed throughout of Angle Girders, and each sliding section is built up from two 24½" Angle Girders joined together by Strips. The rungs consist of Rods of suitable size. The frame on which the complete escape is mounted is built up from four 7½" Angle Girders braced by large Corner Brackets and fitted with the axle on which the two large wheels are mounted. These wheels consist of a number of Strips bent into a circle and surrounded by a thin strip of tin-plate. The method of mounting the escape for transport purposes is shown in our illustration of the model.

The Scammell fire engine that is the subject of Mr. Lawford's model is shown in the lower illustration on this page. The powerful turbine pump is mounted at the rear, and its output ranges from 200 gall. of water per min. at a maximum pressure of 200 lb. per sq. in., to 830 gall. per min. at 50 lb. per sq. in. The bodywork is of wood, and there are seats along each side for the firemen. Suction hose is carried on the top centre of the body and lockers provide storage space for a further 2,000 ft. of hose and for other necessary equipment. At the rear is a control panel arranged so that if necessary one man can take complete control of the vehicle during pumping operations.

Meccano Suggestions Section

Edited by "Spanner"

(340)—Unusual Digging Motion for a Mechanical Excavator (P. Duncan, Shrewsbury)

Wherever digging operations are carried out on a large scale, some form of mechanical excavator is invariably employed. The type of excavator that is used depends upon the conditions under which it has to work. When the machine is situated higher than the ground that is to be excavated, a dragline or trench shovel is used; but if the machine is operating against, say, a cliff face, the digger bucket is attached to a pivoted arm at the front of the machine for scooping up loads of material. Excavators of the latter type usually resemble a swivelling crane, the bucket arm being pivoted to the jib and operated by a hoisting cord that passes over the jib head pulley.

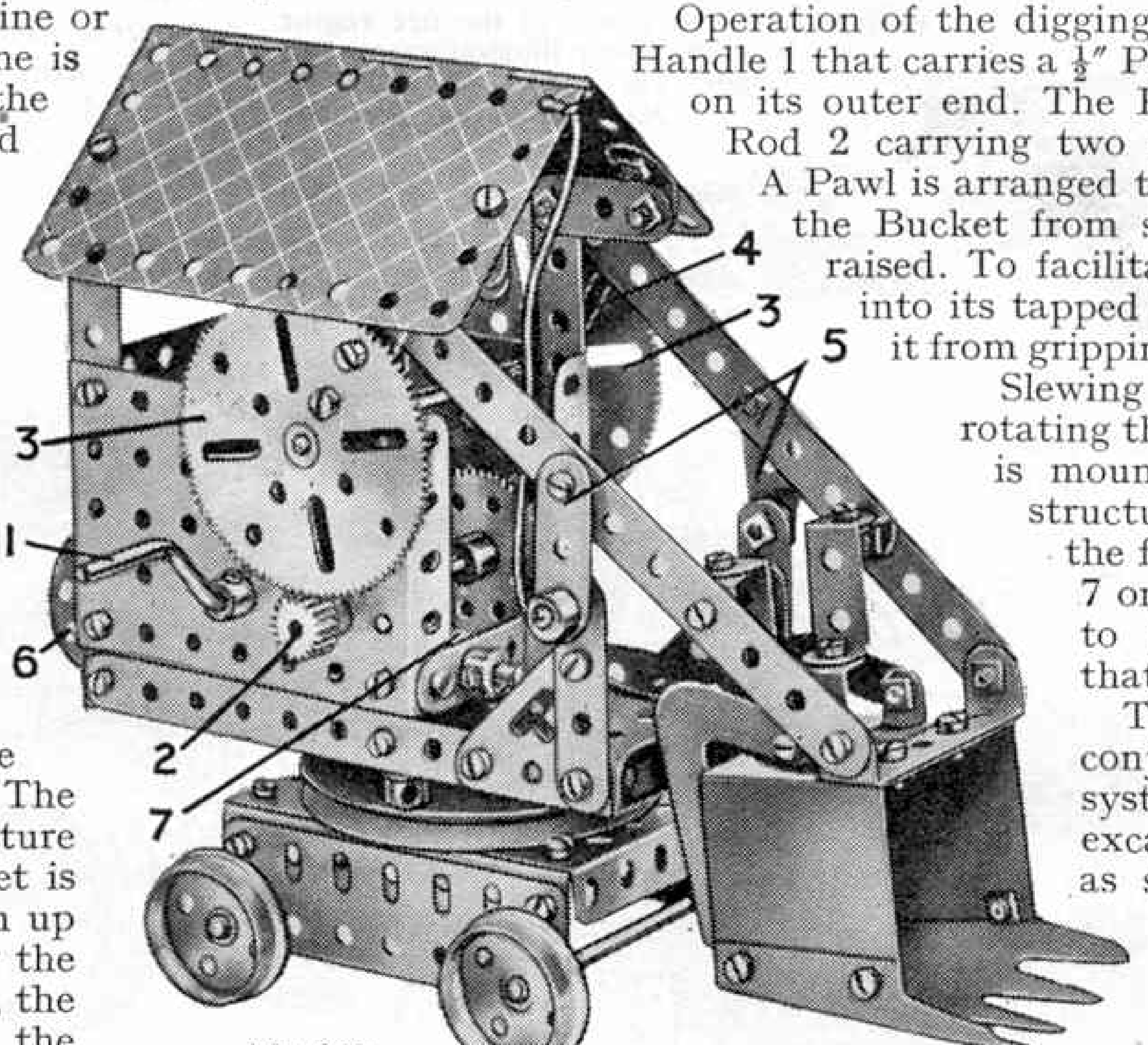


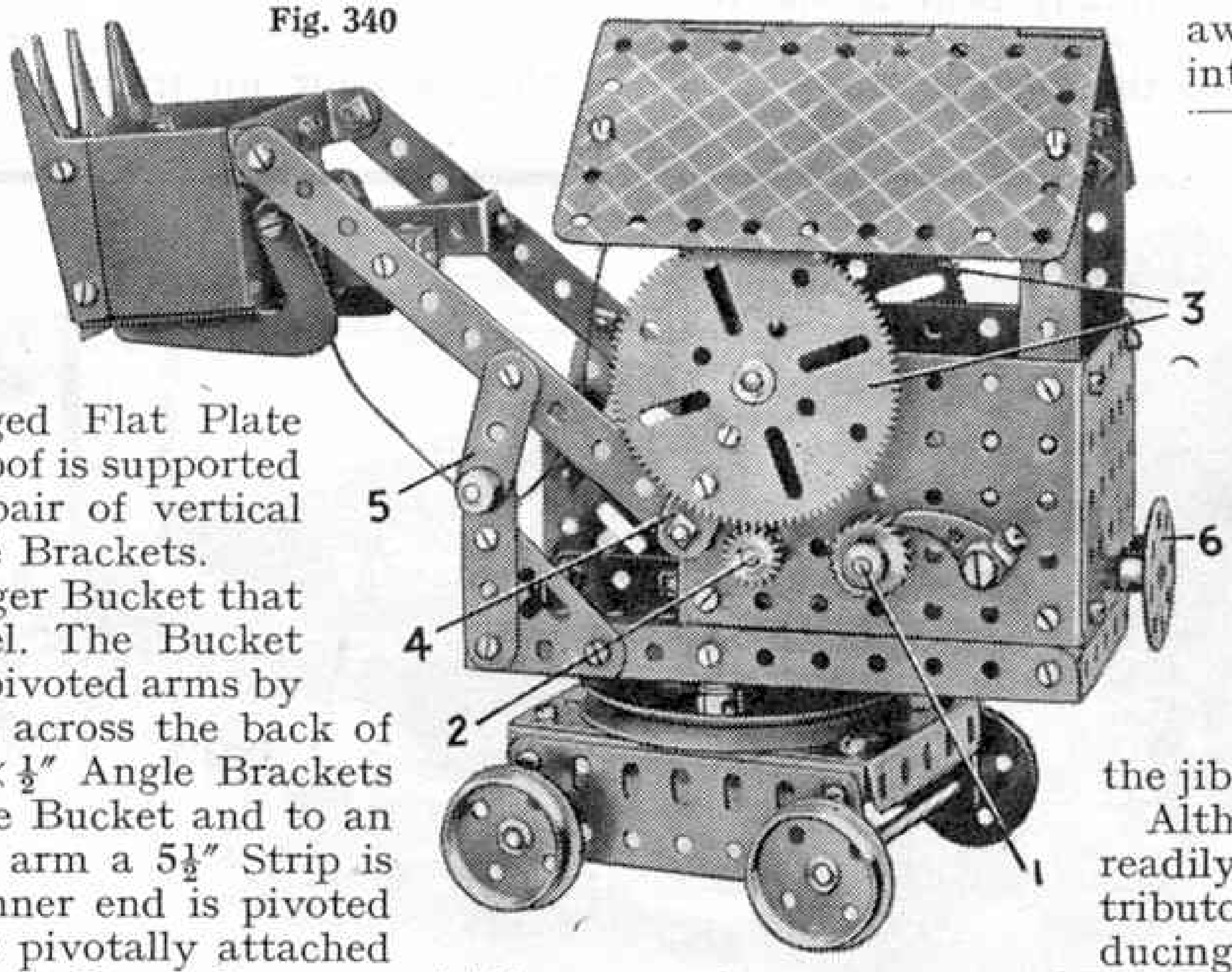
Fig. 340a

The novel excavator illustrated in Figs. 340 and 340a dispenses with a jib, the bucket being driven forward and upward with a scooping movement derived from a system of levers and links. Fig. 340a shows the bucket in position ready to scoop its way into the cliff face, and Fig. 340 shows the raised position of the bucket when full. The next operation is to slew the upper structure of the travelling unit so that the bucket is brought into position over trucks drawn up to receive its contents. By withdrawing the bolt in the bottom of the Digger Bucket, the bottom drops away, thus discharging the contents. In operating, the excavator may run on rails that are extended as work proceeds, or it may travel on caterpillar tracks.

For the model the travelling base is composed of a 3½″×2½″ Flanged Plate, along each side of which is a 3½″ Angle Girder and Flat Girder. The Flat Girders carry the Axle Rods of the Flanged Wheels. A Bush Wheel is bolted beneath the centre of the Plate and grips a 1½″ Rod projecting upward to form the pivot for the superstructure.

The rotating structure is built up on a 5½″×2½″ Flanged Plate beneath which is a 3″ Pulley fixed with its boss uppermost. The Pulley is secured by ½″ Bolts, on each of which a Collar and two Washers are fitted for spacing the Pulley from the Plate.

Fig. 340



Four 5½″ Strips are bolted to the side flanges of the Plate and carry 3½″×2½″ Flanged Plates and a 2½″×2½″ Flat Plate. Obtuse Angle Brackets are attached to the upper ends of the rear pair of Strips and support the Hinged Flat Plate forming the roof. The front end of the roof is supported by 1½″ Strips attached to the other pair of vertical Strips and to the roof by Obtuse Angle Brackets.

It is the method of mounting the Digger Bucket that is the chief characteristic of this model. The Bucket is fixed rigidly at the upper ends of two pivoted arms by securing a 2½″×½″ Double Angle Strip across the back of the Bucket, and by means of two 1″×½″ Angle Brackets attached to a Double Bent Strip on the Bucket and to an Angle Bracket on each arm. For each arm a 5½″ Strip is used, and in the fifth hole from the inner end is pivoted to a link 5. The ends of the Strips are pivotally attached to 1½″ Strips 4 bolted to the 2½″ Gears 3. These Gears are rigidly fixed to an Axle Rod, so that the Strips 4 are in corresponding positions. Threaded Pins attached to vertical 2″ Strips support the links 5, which are free to pivot and are retained in place by Collars. Two Washers are placed on each Threaded Pin before the 1½″ Strips 5 are fitted in position.

Fig. 340a shows the Bucket ready to take up a load. To operate the Bucket, the Gears 3 are rotated in a clockwise direction, as seen in this illustration, thus moving the ends of the Bucket arms forward and downward. The links 5 allow the Bucket to move forward until the Strips 4 are in line with the Bucket arms. Further movement of the Gears 3 produces an upward movement of the Bucket until the position shown in Fig. 340a is reached. During this movement the links 5 swing outward and back again.

Operation of the digging movement is effected from the Crank Handle 1 that carries a ½″ Pinion and is fitted with a Ratchet Wheel on its outer end. The Pinion engages a 57-teeth Gear on the Rod 2 carrying two ½″ Pinions that operate the Gears 3. A Pawl is arranged to engage the Ratchet Wheel to prevent the Bucket from swinging back again after it has been raised. To facilitate moving the Pawl a bolt is screwed into its tapped bore and locked with a nut to prevent it from gripping the Pivot Bolt on which it is mounted.

Slewing of the superstructure is effected by rotating the Wheel 6. The Rod of this Bush Wheel is mounted in the Plate at the rear of the structure, and in a 2½″ Strip bolted between the front flanges of the side Plates. A Worm 7 on the Rod engages a ½″ Pinion attached to the upper end of the vertical Rod that is secured to the base.

This is an excellent model for use in conjunction with a Hornby Railway system. It can be used for carrying out excavating operations in material such as sand or gravel, and can be arranged to run on Meccano rails. Hornby Track should be arranged parallel with the excavator track at a suitable distance so that when the Bucket arm, in the raised position, is swung at right angles to the track, it comes into position directly above the Hornby Wagons.

A length of cord is attached to the bolt in the hinged bottom of the Bucket, and when this is pulled the load is released into the Wagon. The excavator then slews round to the working position, drops the Bucket and takes another load, advancing towards the working material as work progresses. If rails are laid for it to travel on they must be extended as work proceeds. As one Wagon is filled up, the next is moved into position, until a complete train load is ready to move away, and a train of "empties" is brought into position again.

(344)—Two-movement Gear-box (P. A. Morris, Stockport)

To use a Clockwork or Electric Motor for driving more than one movement generally calls for the use of Gears, so that with a small Outfit the Motor is restricted to drive one movement only, as Pulley systems are not so adaptable as gears. Some models are greatly improved if two different operations can be driven from the Motor; for instance, a jib crane can be made to raise or lower the jib as well as hoist the load.

Although pulley arrangements are not readily adapted for several drives our contributor has devised an ingenious way of producing two movements from one power unit, using two sets of Pulleys and cords. The Clockwork Motor is pivotally mounted between the two driven Pulleys, and the driving cords are arranged so that when one is taut the other is slack. A Strip bolted to the Motor serves as a lever for swinging it on its pivot. In this way the drive is changed from one cord to the other by respectively slackening and tightening them.

A similar arrangement can be applied to cranes in which a non-reversing Motor is used for hoisting the cord. By slackening the driving belt the load can be allowed to descend under gravity, but the weight of the Motor normally keeps the belt taut.

(341)—Simple Ackermann Steering Gear (F. Sanders, Glasgow)

Models of motor cars and lorries should always be fitted with a representation of Ackermann steering gear if the range of parts available will allow. The alternative is to have the pivoted front axle type of steering such as is fitted to steam tractors, but this is a very poor substitute. With the small Outfits difficulty may be experienced in designing suitable mountings for the stub axles, owing to the limited range of parts; but it is well worth while giving a little careful thought to the steering gear as it can make such a big difference to the appearance of the finished model.

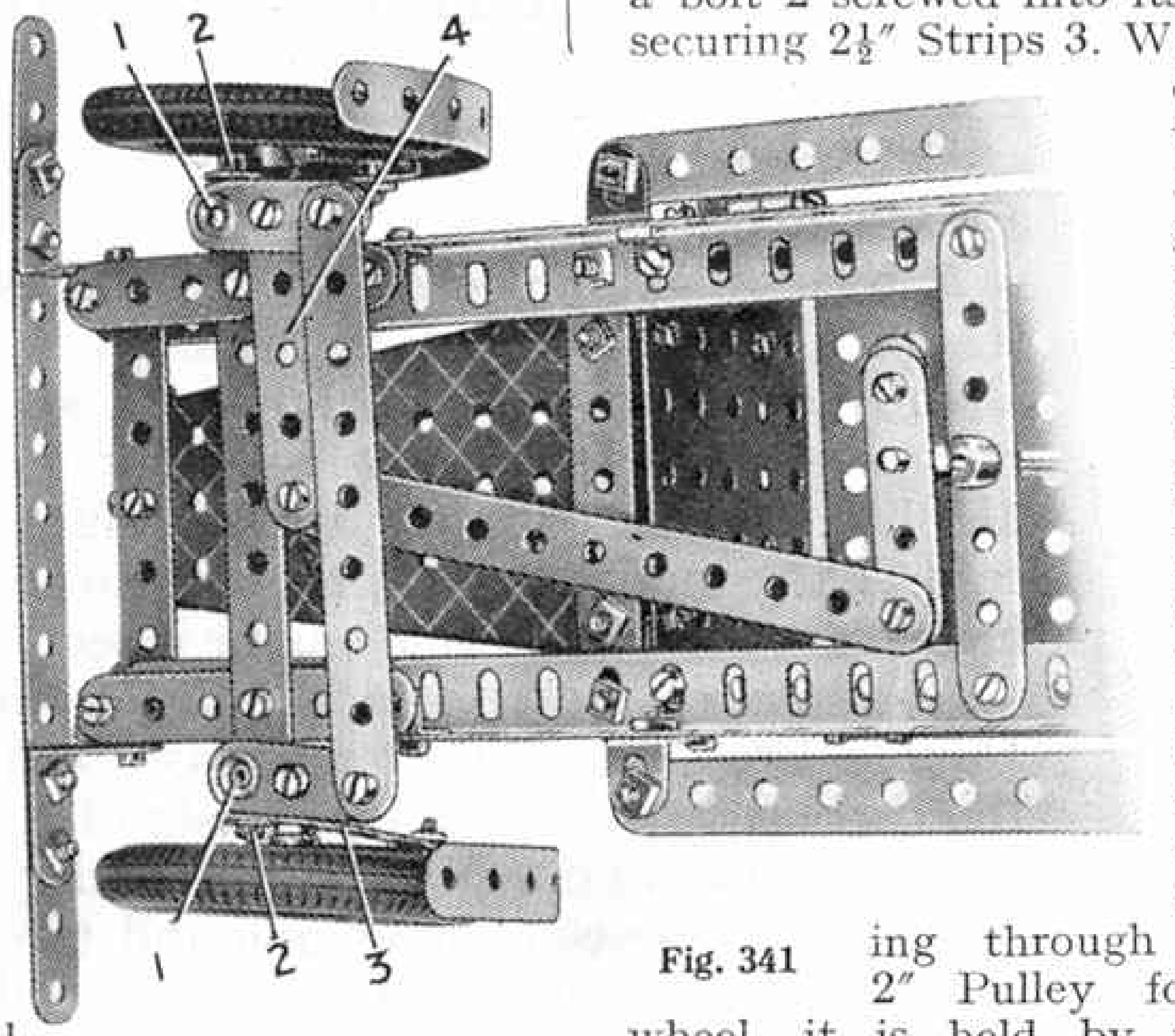


Fig. 341

A simple way of constructing a stub axle steering mechanism of the Ackermann type is shown in Fig. 341, and with slight modifications it can be fitted to cars built with quite small Outfits. Two 4½" Strips form the rigid front axle, and ⅜" Bolts 1 are passed through the end holes and gripped in the bosses of Cranks. The Cranks are connected together by another 4½" Strip, and although in this case Strips of 4½" are used, if these are not available shorter Strips can be joined together to make up the same length. One of the Cranks has a 2½" Strip 4 bolted rigidly to it, the other end of the Strip being connected by a 5½" Strip to a Crank on the lower end of the steering column. The Crank is extended by a short Strip.

Each of the Cranks on the ⅜" Bolts 1 has a bolt 2 screwed into its boss, these bolts securing 2½" Strips 3. Washers are used to ensure that when the bolts 2 are screwed tight they grip the Strips securely. Grub Screws in the opposite bores of the Crank bosses are used to grip the Bolts 1. The 2½" Strips 3 serve the dual purpose of supporting the cycle-type wings and the stub axles. A ⅜" Bolt is used for each stub axle. After passing through the boss of a 2" Pulley forming the road wheel, it is held by two nuts to its respective vertical Strip 3. Angle Brackets attached to the upper ends of these vertical Strips carry the wings that are formed from further Strips suitably curved.

When the steering wheel is turned, the Crank and Strip on the lower end of the steering Rod turn with a corresponding movement. The movement is imparted to the Strip 4 through the pivoted connecting link, and as the Strip 4 is rigidly fixed to its Crank, this also is deflected. Both Cranks are connected by the 4½" Strip forming the track rod so that they move simultaneously, thus steering the vehicle.

(342)—Toggle Mechanism

(J. Coombs, Reading)

A toggle mechanism is a simple link motion that transmits reciprocating movement at right angles to the operating force. The resultant movement is through a shorter distance than the original motion, but is considerably more powerful. Toggle movements are applied in particular to presses where a very powerful action is required.

The general principle of operation of a toggle press can be seen from Fig. 342. An Eccentric operates the toggle links, one of which is pivoted on a ⅜" Bolt 1. The Bolt is secured to the frame, in this case a Flanged Plate, by means of two nuts; and two more nuts are locked on the Bolt to retain the toggle link in place. The second link, also pivoted to the Eccentric, is attached to the sliding Eye Piece 2. As the Eccentric rotates it moves the links into a position where they both lie in a straight line, the movement of the Eye Piece 2 decreasing in speed as the links approach the straight-line position. Thus the power exerted by the Eye Piece increases towards the end of the power stroke.

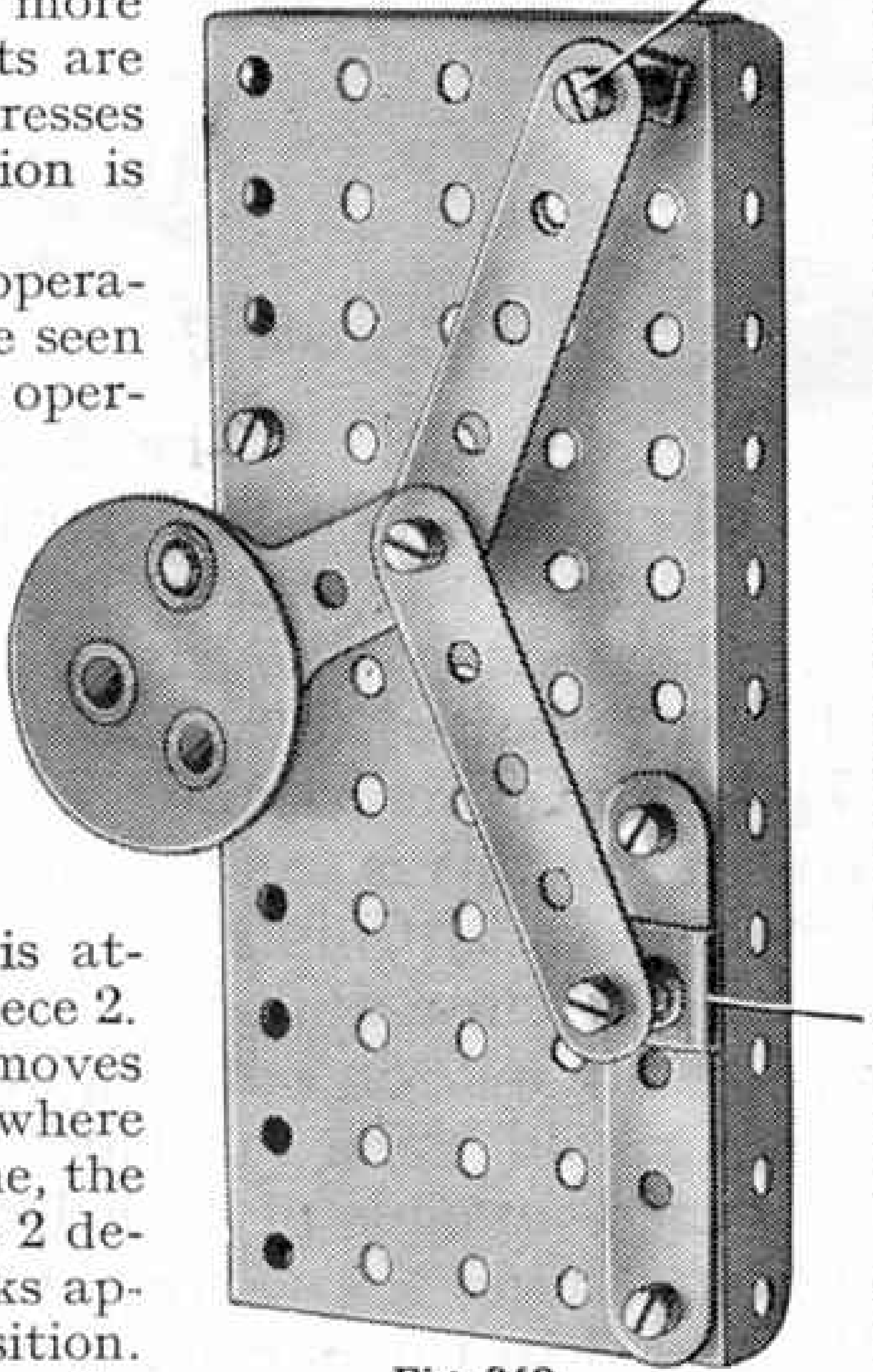


Fig. 342

A double stroke can be obtained for one revolution of the Eccentric by arranging the links to be carried beyond the straight-line position. In this way two strokes of different length can be produced.

(343)—Bevel Reduction Gear

(S. Jameson, Coventry)

Meccano Bevel Gears Nos. 30a and 30c are intended for use together and not for meshing with the ⅞" Bevels No. 30. In spite of this our contributor has devised a very ingenious reduction gear making use of all three sizes of Bevels. The mechanism is essentially an epicyclic gear, and produces several ratios according to the way it is driven.

The Axle Rod 1 carries a ½" Bevel 2 that is fixed to it, and a Double Arm Crank that is free on the Rod. The Crank has attached to it a 1½"×½" Double Angle Strip and is retained in position between two Collars. An Obtuse Angle Bracket at each end of the Double Angle Strip carries a Pivot Bolt on which a ⅞" Bevel is free to rotate. These Bevels are so arranged that they mesh with the Bevel 2, and also with a 1½" Bevel 4 free on the Rod 1.

To use the mechanism as a reduction gear, the Bevel 4 can be secured to prevent it from rotating, and the Rod is driven from the power unit. The drive would then be taken from the Double Arm Crank of the frame 3 by means of a Socket Coupling, in which case the lower Collar on the Rod 1 would be removed. An alternative arrangement is to secure the cage 3 and drive between the Rod 1 and Bevel 4.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.185.) A New Use for Spring Clips.—D. Slow (London, N.14) suggests a novel way of using Spring Clips as coil springs. A Clip is clamped between Strips or Flat Brackets attached to the framework of the model, and the Strip that is to be sprung-mounted is clamped by means of a Flat Bracket or a second Strip to the other lug of the Spring Clip. This method of mounting a Strip will be found applicable to vibrating mechanisms such as the make-and-break of a buzzer or shocking coil.

(M.186.) Remote Control for No. 1 Motor Cars.—When racing Meccano Motor Cars it is difficult to steer them without getting in the way of other competitors and without influencing their speed when moving the steering wheel. Our contributors K. Jones and T. Guest (Wallasey, Cheshire) have devised a simple way out of this difficulty, by steering the Cars with flexible wire such as that used for hanging curtains. The wire forms an extension of the steering column and is attached to the steering wheel by means of a small piece of tin that is slightly longer than the diameter of the wheel, and consequently can be fitted over the centre of the wheel but with its ends under the rim. The curtain wire is attached to the centre of the tin, the best method being by soldering it, and at the upper end the wire is fitted with another wheel or suitable handle for turning it.

No doubt some good fun can be had by racing cars in this manner, and readers might well try this method of control.

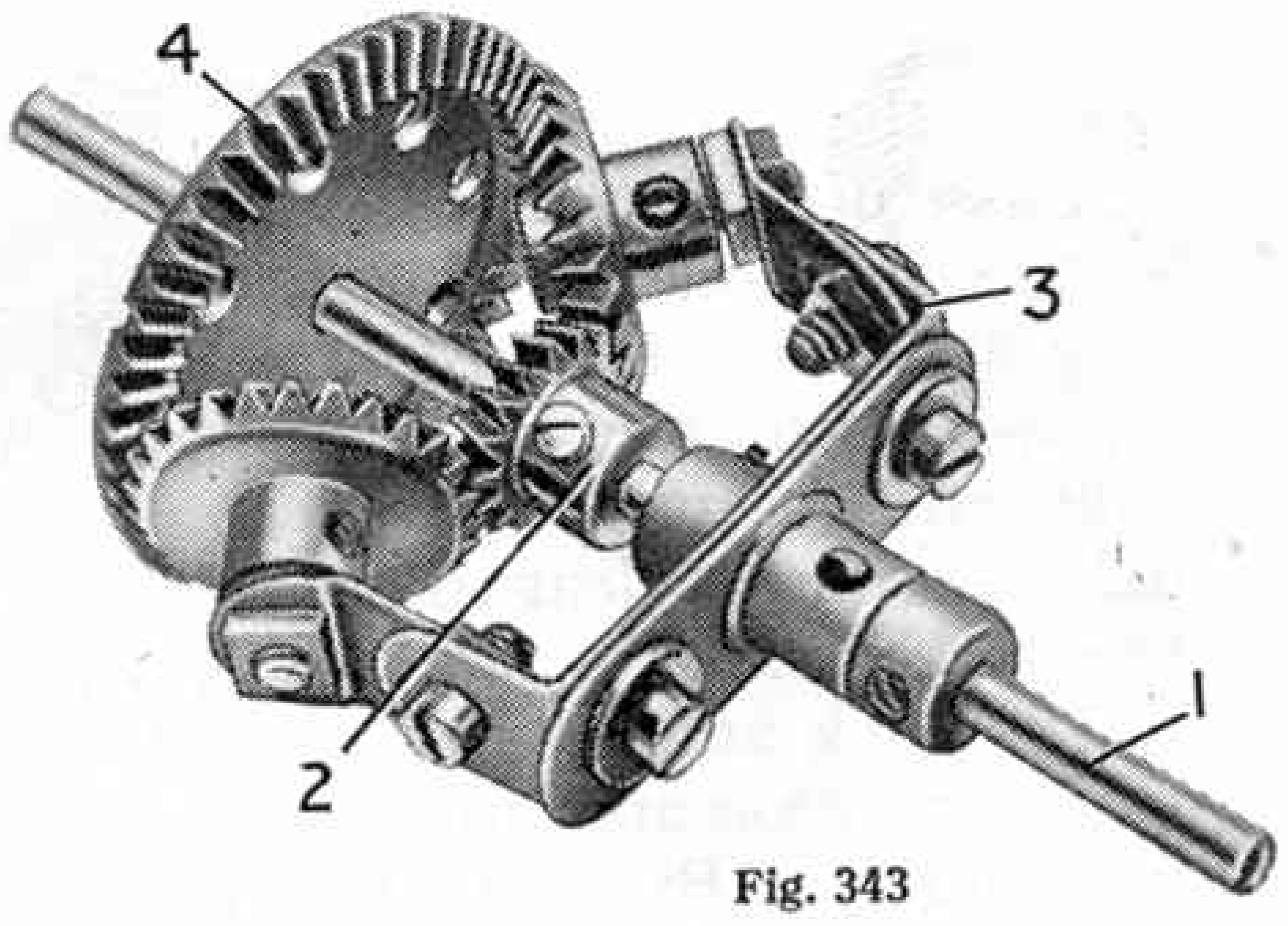


Fig. 343

(M.187.) Small Free Wheel.—This idea by James R. Weldon (Newcastle-on-Tyne) is for a smooth-acting free wheel built up from a Bush Wheel and ½" Pulley. The Bush Wheel is free on the Rod of the Pulley, and carries a 1½" Strip that is pivotally attached to it. The Strip is spaced so that it is in line with the groove of the Pulley, and cord is tied to each end of the Strip and passed round the ½" Pulley. It is upon the method of fixing this cord that the operation of the free wheel depends. A nut and bolt is fixed at each end of the 1½" Strip and the cord is clamped beneath the nuts. The cord is clamped nearer to one end of the Strip than the other, and it will be found that if the cord is of the correct length the Bush Wheel rotates freely in one direction, but is automatically locked to the Pulley when turned in the other direction.

If the Bush Wheel is to rotate fairly fast, the weight of the 1½" Strip should be counterbalanced by securing Flat Brackets or Washers diametrically opposite. If this is not done vibration will be set up by the unbalanced Wheel.

Aero Engines in Meccano

Splendid Examples of Realistic Construction

A NOTABLE feature of the entries for Meccano Model-building Competitions is the absence of models of aeroplane engines. It is probable that this absence is due mainly to two causes. The first is the apparent complexity of construction of such engines; the second is that the peculiar shapes and moulded sections so prominent in engines of this type necessitate the bending of Meccano parts, which naturally is a thing that Meccano enthusiasts are reluctant to do. As to the complexity of aero engines, it is hoped to show in this article that simple but very realistic models can be built with little difficulty. The bending problem has been solved to a great extent by the introduction of the Meccano Strip Plates and Flexible Plates.

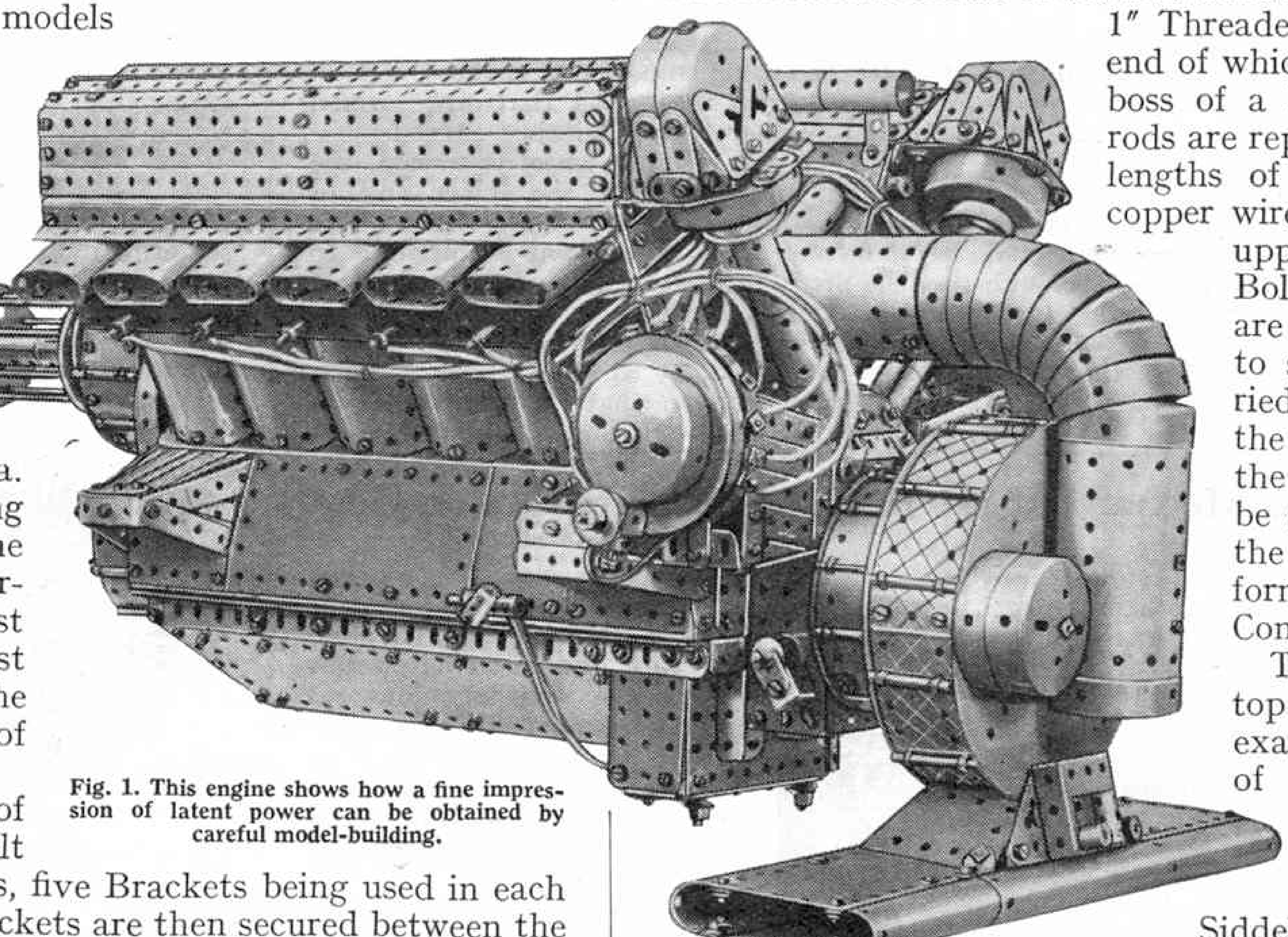


Fig. 1. This engine shows how a fine impression of latent power can be obtained by careful model-building.

The simplest of the models used to illustrate this article is shown on the right of Fig. 2. This is a miniature reproduction of a five cylinder 185 h.p. "Regulus II" engine constructed by the Walter Motor Cars and Aero Engines Ltd., Czechoslovakia. One of the outstanding features of this engine is the method of arranging the exhaust pipes which are just sufficient to guide the exhaust gases clear of the fuselage.

The back and rear of the crank case are built up from Flat Brackets, five Brackets being used in each case. Five Double Brackets are then secured between the front and rear and each of these has an Obtuse Angle Bracket secured to it. The end hole of each Obtuse Angle Bracket accommodates a ⅜" Bolt on which is secured a Worm by means of its Grub Screw.

The five Worms represent the cylinders, and push rods for operating the valves of these are formed from 22 S.W.G. bare copper wire, or any other wire approximating to this. These push rods are held in place, at their lower ends, behind a 1" fast Pulley representing the front of the crankcase. A similar Pulley at the rear of the engine is also carried and a 2" Rod, protruding at the front to form the propeller hub, holds both Pulleys in position. Two Collars are fitted to this Rod as shown. Exhaust pipes consist of short lengths of Spring Cord, down the centres of which short lengths of 22 S.W.G. copper wire has been passed. This wire fulfils the dual purpose of securing the lengths of Spring Cord to the cylinders and also retaining their shape.

When the engine is completed it is best mounted as shown on a short Rod that is secured in the boss of a Face Plate.

A second engine, on the left-hand side of the illustration, is constructed in a similar manner to that already described. It has, however, seven cylinders and represents an Armstrong Siddeley "Lynx" engine of 215 h.p. In this example a Face Plate is carried on the rear of the model to give the appearance of the ring by means of which the actual engine is secured to the fuselage.

A Threaded Boss, attached by a bolt to one of the Double Brackets of the crankcase, forms a support for the carburetter. This unit consists of a second Threaded Boss, a Collar and a ¾" Bolt, this latter part forming the connection between the engine and the carburetter. The bottom threaded hole of the first Threaded Boss carries a 1" Threaded Rod, the lower end of which is locked in the boss of a Face Plate. Push rods are represented by short lengths of 18 S.W.G. bare copper wire secured at their upper ends to ⅜" Bolts. These Bolts are attached in pairs to similar Bolts carried in the tops of the Worms forming the cylinders. As will be seen, the front of the crankcase is formed from a 1½" Contrate Wheel.

The engine at the top of Fig. 2 is a fine example of this type of model-building, the prototype being a 275 h.p. Armstrong Siddeley "Cheetah V."

The front of the crankcase of this model consists of a Boiler End and a Wheel Flange, a 1½" Contrate being attached to the Boiler End as shown. The rear of the crankcase is built up from a Wheel Flange bolted to a Flanged Disc, Part No. 168a.

A 7½" Flat Girder is now bent round the two Wheel Flanges and to this is secured the cylinders. Each of these is formed from a Chimney Adaptor, a small Flanged Wheel, six 1" loose Pulleys and a Double Bracket. All these parts are held in position on a 2½" Rod, and Collars are used to hold them in place.

The turned-up ends of each Double Bracket carry two Couplings forming the valve covers. Push-rods consist of 1½" Rods held in the end holes of these. Plugs are represented by nuts and bolts, and the high tension cable consists of lengths of rubber covered wire.

Probably one of the finest model aero engines constructed from Meccano parts is illustrated in Fig. 1. This model is an accurate scale reproduction of a twelve cylinder, super-charged, Rolls-Royce "Buzzard" engine.

This engine develops 825 h.p. and is fitted into a great many commercial and military aeroplanes. The S.B.6 Seaplane, which won the Schneider Trophy in 1931, was fitted with an improved engine of this type developing 2,300 b.h.p.

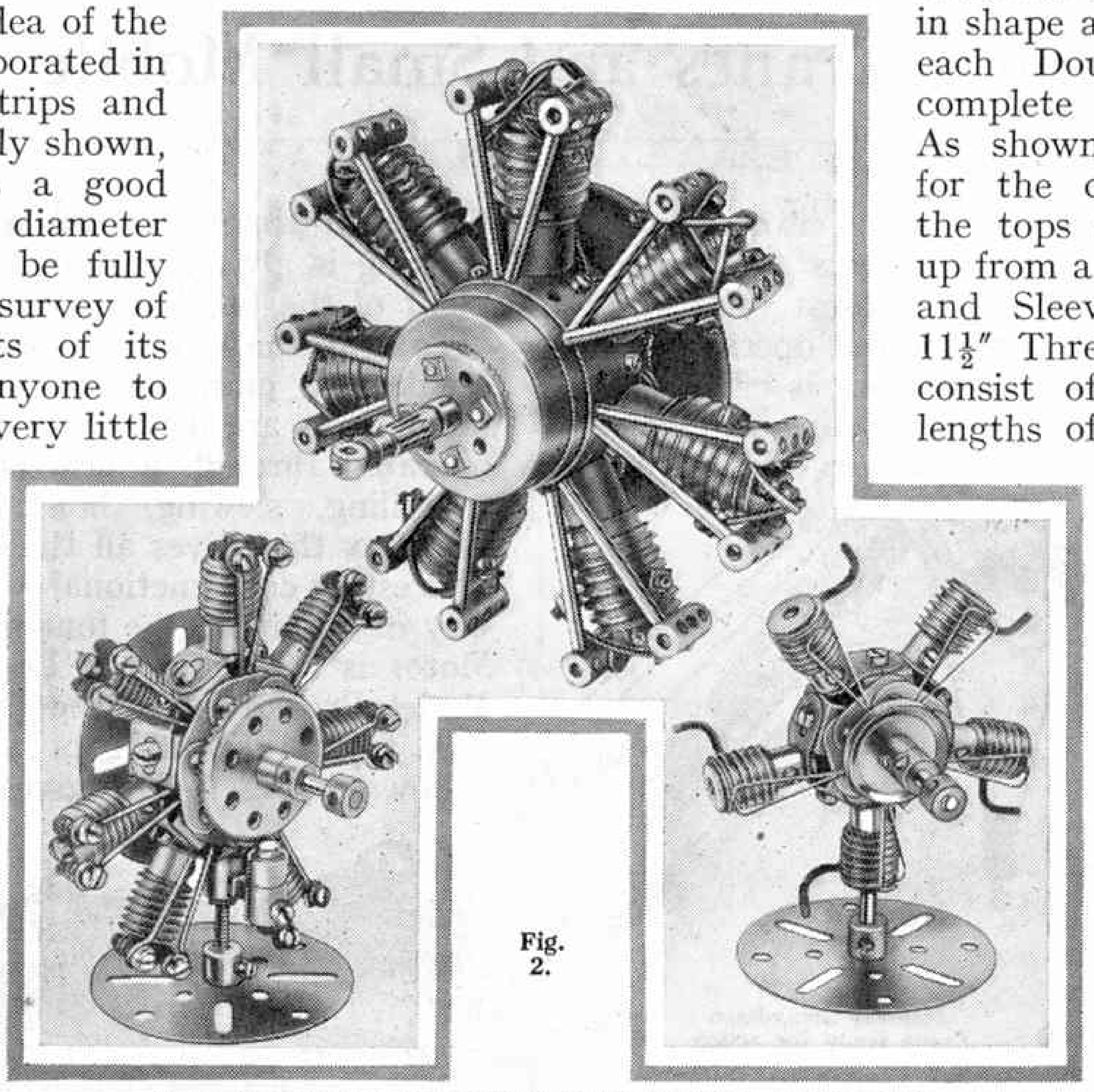


Fig. 2.

Three clever Meccano air-cooled engines described in this article.

Figs. 1 and 3 give some idea of the great amount of detail incorporated in this model. The uses of Strips and Flexible Plates are graphically shown, and the induction pipe is a good example of built-up large diameter piping. The model cannot be fully described here, but a brief survey of the more important points of its construction will enable anyone to build a similar model with very little difficulty.

The sump framework is built up from two 12½" reversed angle girders, and these are fitted on their lower edge with a number of Obtuse Angle Brackets. These Brackets carry, on each side of the framework, a 9½" Strip Plate, and the two Plates when fitted are connected together at their lower edges by a 9½" Strip and a further set of Obtuse Angle Brackets. The Strip Plates terminate 1" from the forward end of the sump and 2" from the rear end. The gap at the front is filled in by means of Strip Plates bent to the required shape. The oil pump housing covers the gap at the rear of the sump, this being built up from 4½"×2½" and 3"×1½" Flat Plates.

The crankcase, at its centre, is formed from 5½" Strip Plates, curved as shown in Fig. 1, and at each end of these are fitted the engine "feet." These "feet" carry the weight of the real engine when incorporated in the fuselage.

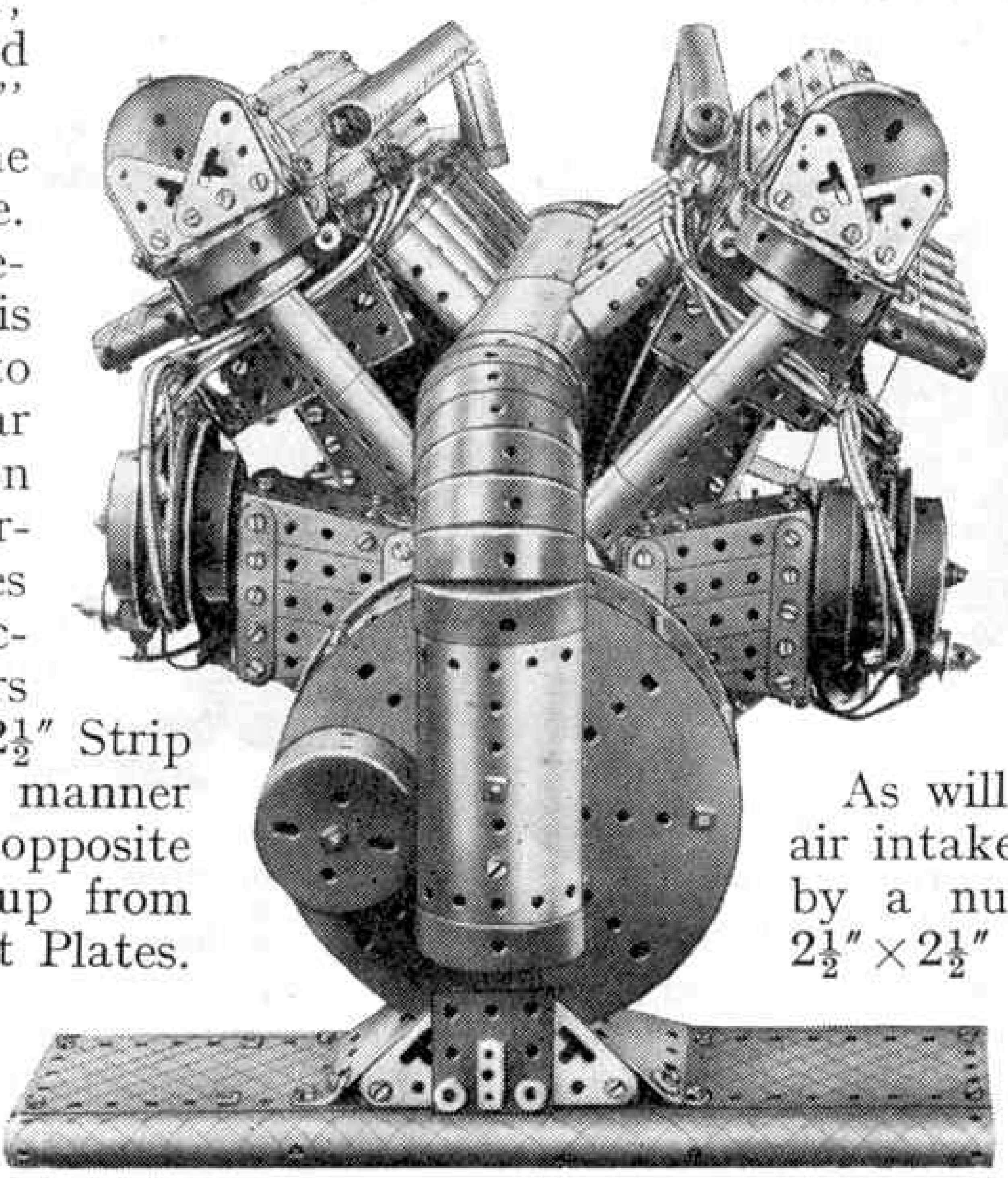


Fig. 3. A rear view of the water-cooled engine shown in Fig. 1.

The casing surrounding the reduction gearing of the airscrew, is represented in a similar manner to the supercharger fitted to the rear of the model. The upper portion is 4" in diameter and the lower portion 3" in diameter, 4" Circular Plates and 3" Pulleys being used respectively. The walls of the cylinders on the outside consist of six 2½"×2½" Strip Plates curved to shape in the manner shown in the illustration. On the opposite side, the cylinder walls are built up from two 5½"×2½" and one 2½"×2½" Flat Plates. The upper portion of the cylinders takes the form of a box built up from Angle Girders and Flat Plates and measuring 12½" in length, 2½" in height and 2½" in width. The camshaft covers are shown plainly in Figs. 1 and 3.

The upper portion of each cylinder block is fitted with a 12½" Angle Girder and this forms the support for the short exhaust pipes. In actual practice these are usually lengthened as required so that they protrude a few inches from the sides of the aeroplane. In the model they are represented by means of 5½"×2½" Flexible Plates bent to the shape shown and overlapped 1½" at each end. They are fitted with Double Brackets at the rear to retain them in shape and one of the bolts holding each Double Bracket secures the complete exhaust pipe in position. As shown in Fig. 3, return pipes for the circulating water fitted to the tops of the cylinders, are built up from a series of Chimney Adaptors and Sleeve Pieces mounted on an 11½" Threaded Rod. Sparking plugs consist of Rod Sockets fitted with lengths of rubber covered wire. The free ends of these wires are connected to Pivot Bolts on the magneto distributors.

The construction of the supercharger is shown clearly in the two illustrations. The large induction pipe, typical of nearly all Rolls-Royce engines, is built up from a number of Boilers, without ends. The Ends are arranged in the manner shown in order to form the curved portion of the pipe. Three Flexible Coupling Units, fitted with Collars, hold the separate sections of this curved pipe in position. The portion of the induction pipe that passes between the cylinder blocks, is fitted with twelve 2" Threaded Rods held in place by means of nuts. Each Threaded Rod supports a Sleeve Piece and Chimney Adaptor, the complete unit representing a feed pipe for a cylinder.

The air intake is situated immediately below the supercharger casing, as shown in Fig. 3. It consists essentially of two 12½"×2½" Strip Plates and the edges of these are fitted with 5½"×2½" Flexible Plates as shown in the illustration. To secure the Strip and Flexible Plates together, 1" Threaded Rods are used and 12½" Strips are secured on the inside of the complete intake for strengthening purposes.

As will be seen, the connection between the air intake and the supercharger casing is made by a number of large Corner Brackets and 2½"×2½" Flexible Plates bent to the required shape. Two Obtuse Angle Brackets are used for securing each Flexible Plate in position and two Channel Bearings form a common support for the two Corner Brackets shown in Fig. 3.

Each magneto consists of two 3" Pulleys carried on a 1" Threaded Rod. Nuts on this Threaded Rod press the two Pulleys together, and in this way twelve Pivot Bolts are secured in position. Each Pivot Bolt represents a distributing point, and wires from these, as already described, are connected to the plugs.

In Search of New Models

Breakdown Cranes and Small Mobile Cranes

THERE are many types of travelling crane, almost all of which make fascinating subjects for models, but breakdown cranes are among the most interesting types as they can be used for carrying out operations in the same manner as the breakdown work is effected in actual practice. There are two distinct groups into which breakdown cranes can be divided, those for railway work and those for road service. The former are comparatively large cranes that can handle loads up to 36 tons, whereas the latter are quite small travelling cranes, usually consisting of a small fixed jib attached to the back of a motor lorry. The model-builder who seeks new subjects to build should consider the possibilities offered by these interesting machines.

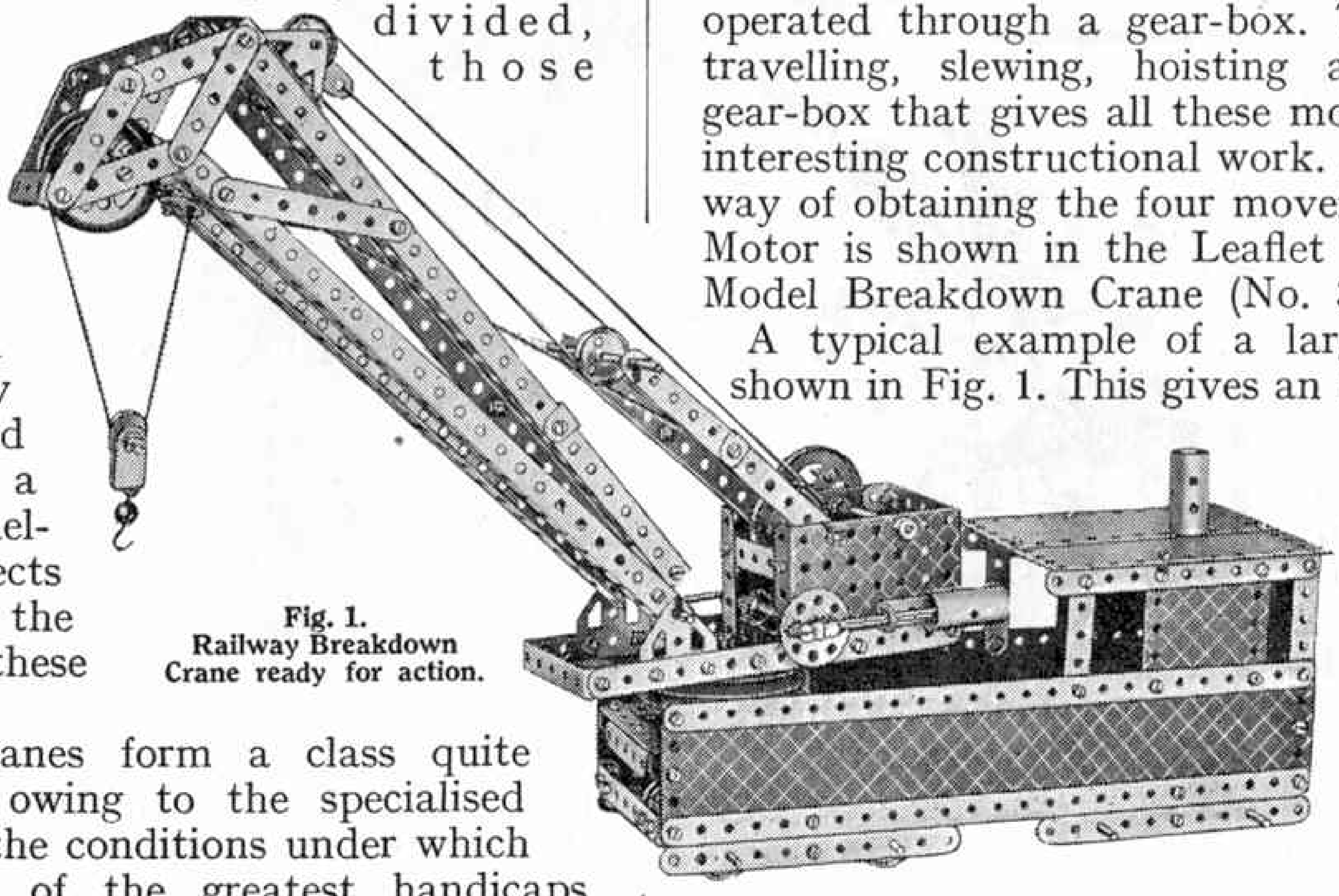


Fig. 1. Railway Breakdown Crane ready for action.

Railway breakdown cranes form a class quite distinct from any other owing to the specialised nature of their work and the conditions under which they must operate. One of the greatest handicaps imposed upon the designer of such cranes is the limits of size necessitated by the railway loading gauge. The crane must be designed so that it does not exceed certain dimensions of width and height when in running trim, neither must the weight on each axle exceed a definite limit. These restrictions naturally have an influence on the lifting capacity of the crane, yet many ingenious features are incorporated on the latest type of breakdown crane in order to enable it to handle increased loads.

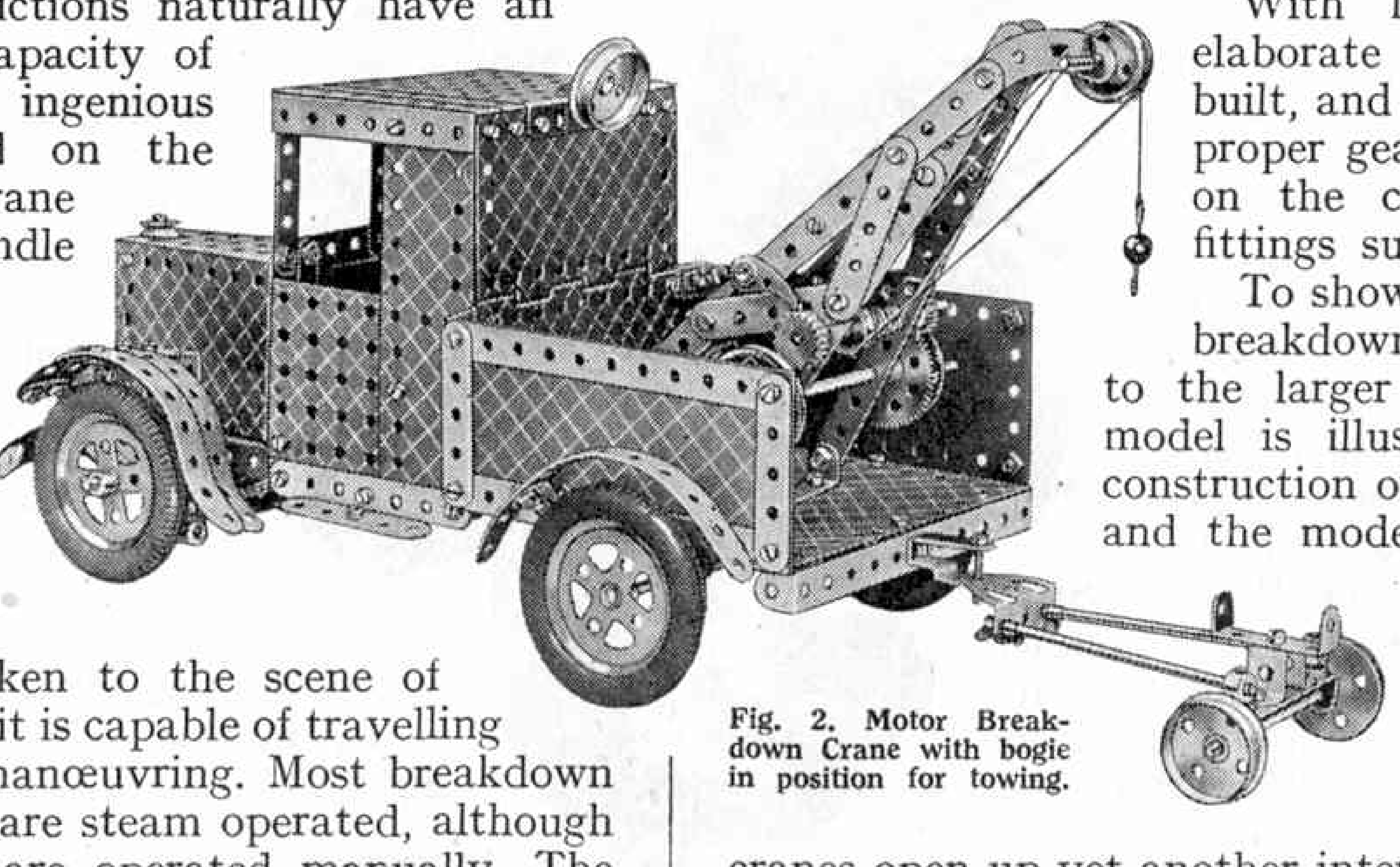


Fig. 2. Motor Breakdown Crane with bogie in position for towing.

When forming part of the breakdown train the crane travels with the jib lowered to the horizontal position and resting on a special truck called a match truck. Although the crane is taken to the scene of operation by a locomotive, it is capable of travelling under its own power for manœuvring. Most breakdown cranes on British railways are steam operated, although some of the lighter ones are operated manually. The general design of large breakdown cranes does not vary much except in the minor details of construction.

Clips are fitted for gripping the rails to enable the crane to handle heavier loads, and to work at right angles to the track without the danger of overturning. For particularly heavy work outriggers are provided to relieve the axles and track of the load. The outriggers consist of stout girders that slide out at right angles to the crane truck, and are supported at their outer ends by baulks of timber known as wood packing. The wood packing is always included in the miscellaneous equipment of the breakdown train.

One of the chief reasons for the popularity of the breakdown crane as a model subject is that all its movements are derived from one set of engines and are operated through a gear-box. The movements include travelling, slewing, hoisting and derricking, and a gear-box that gives all these movements provides much interesting constructional work. A particularly ingenious way of obtaining the four movements from one Electric Motor is shown in the Leaflet for the Meccano Super Model Breakdown Crane (No. 30).

A typical example of a large breakdown crane is shown in Fig. 1. This gives an idea of how the subject can be reproduced with a medium-sized Outfit, and as the Outfit will not permit the construction of an elaborate gear-box the different movements are hand-operated. The Crank Handle operating the hoisting drum through a 3 : 1 gear ratio turns a Bush Wheel that serves as a crank for the dummy steam engine. For simplicity an oscillating type of cylinder is used. Luffing is carried out from a separate Rod fitted with a 2″ Pulley for a handwheel. The entire superstructure swivels on two 3″ Pulleys.

With larger Outfits a more elaborate crane can of course be built, and this can be fitted with a proper gear-box, swivelling bogies on the crane truck, and extra fittings such as outriggers, etc.

To show that the possibilities of breakdown cranes are not confined to the larger Outfits a very simple model is illustrated in Fig. 3. The construction of this is neatly executed and the model closely resembles the type of crane it represents.

Motor Breakdown Cranes

Motor breakdown cranes open up yet another interesting branch of model-building. The actual cranes vary little in their details, but they are mounted on many different types of vehicle. It is not unusual to see a crane mounted at the back of an old touring car from which the rear half of the body has been removed. The more usual type of body is shown in the model appearing in Fig. 2.

These models provide much interest in the construction of the chassis and bodywork, and of course such details as gear-boxes, differentials and steering gear can be

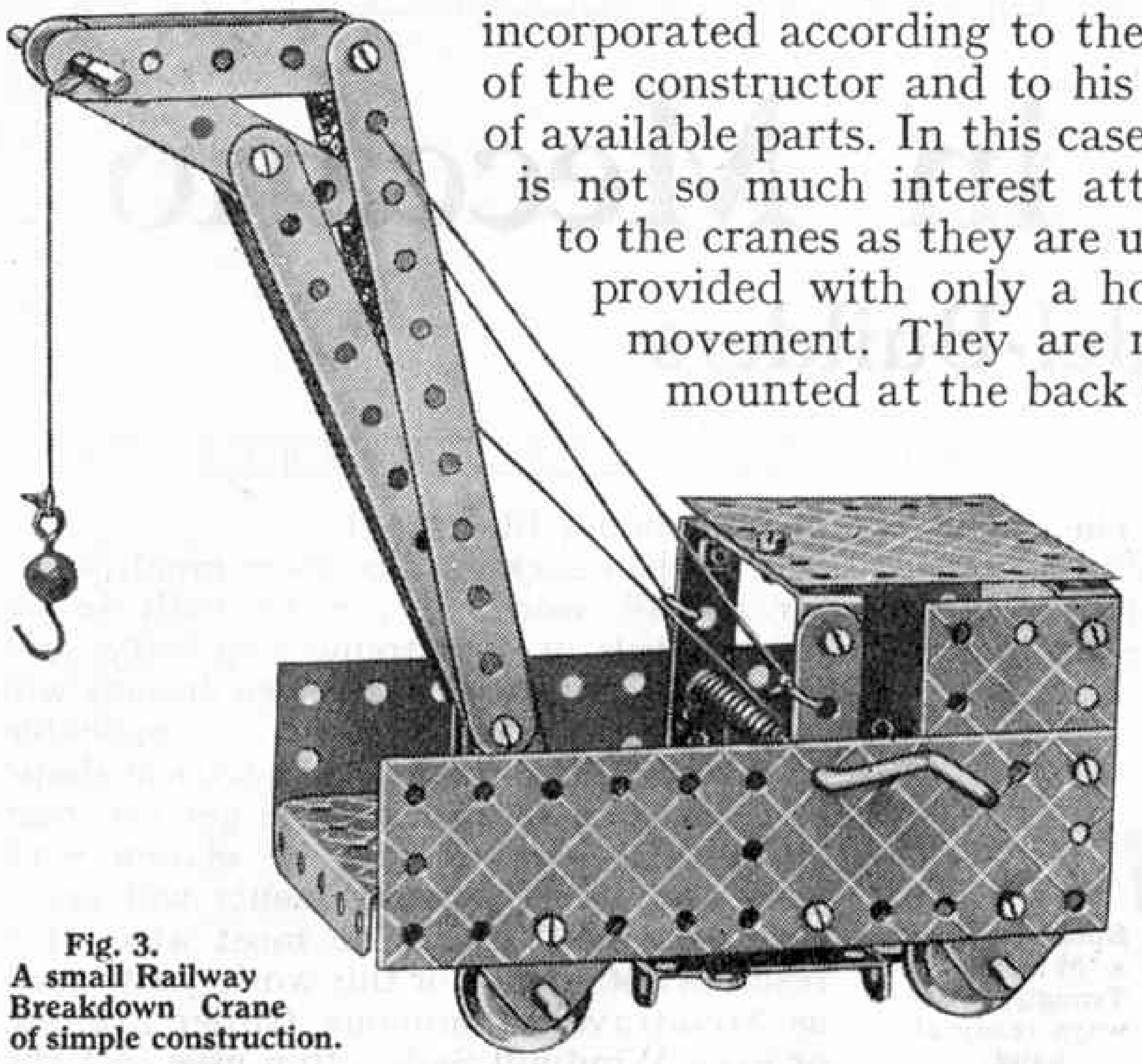


Fig. 3. A small Railway Breakdown Crane of simple construction.

incorporated according to the ideas of the constructor and to his range of available parts. In this case there is not so much interest attached to the cranes as they are usually provided with only a hoisting movement. They are rigidly mounted at the back of the lorry with the jib at a fixed angle, as the special purpose for which they are intended does not necessitate swivelling or derricking. They are generally used for lifting the end of a disabled vehicle that cannot be moved on its own wheels. In such cases it is usually only one pair of wheels that are damaged, and when the vehicle has been raised, a small truck, such as that shown in the model, is pushed underneath to support it. The vehicle can then be towed to the garage for repair.

Small Mobile Cranes

Another interesting type of travelling crane is the small mobile crane that is often used for handling loads up to about 6 tons in warehouses, factories and goods yards. This type of crane is shown in Fig. 5 and an underneath view of it appears in Fig. 4. The unique design of these cranes makes them very easy to manœuvre in confined spaces. They are fitted with travelling, derricking and hoisting movements; and for slewing, the steering gear of the crane is used for swinging the back of the vehicle round in a circle. A small two-wheeled castor at the back of the crane is driven from the motor so that by turning the wheels at right angles to the crane the turning movement of the jib is obtained.

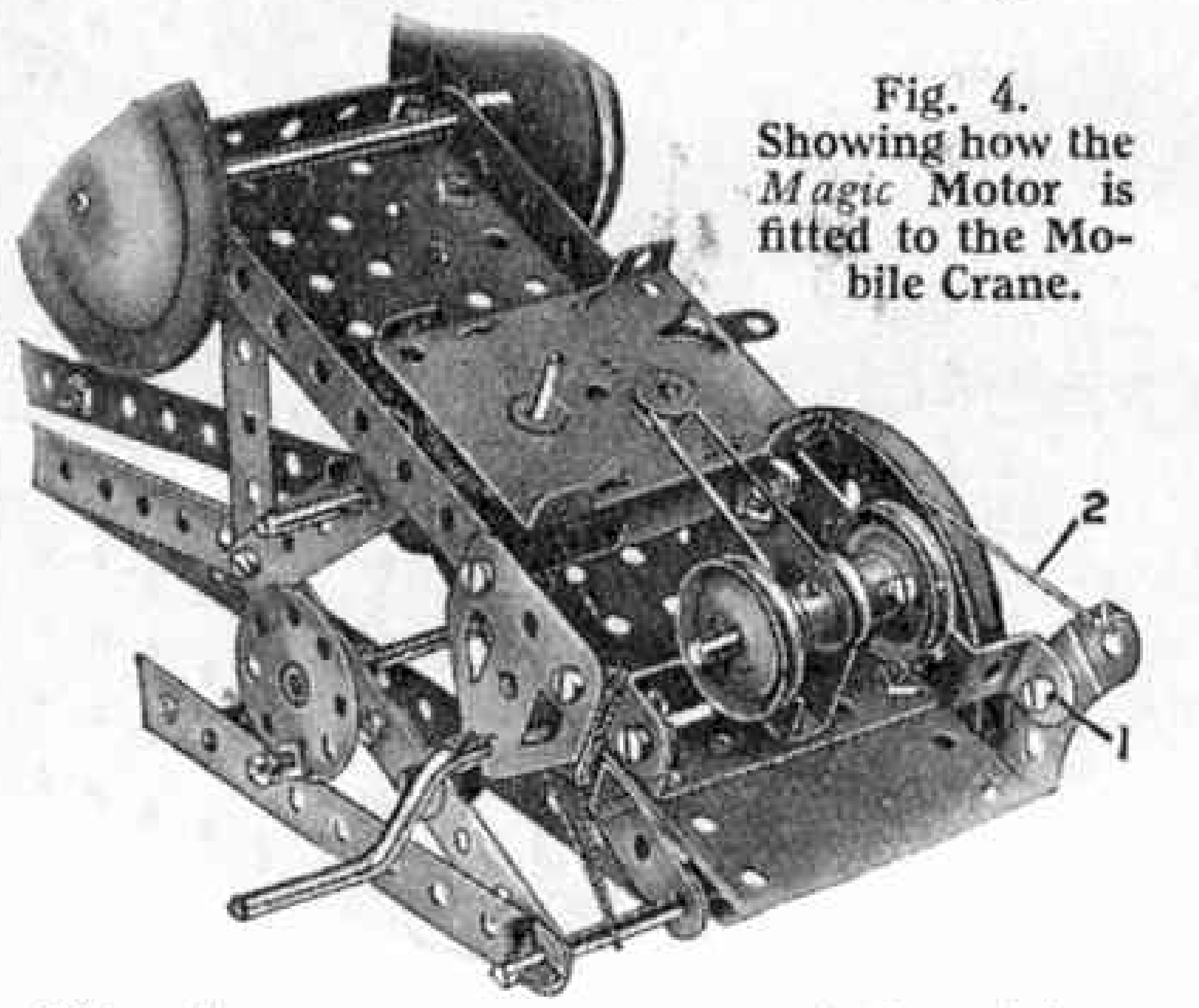


Fig. 4. Showing how the *Magic* Motor is fitted to the Mobile Crane.

A petrol engine drives the electric generating plant that supplies current for electric motors controlling the different movements. Three separate motors are provided to give independent drives for hoisting, luffing and travelling, the motor for travelling being mounted on the rear castor. When the castor is turned at right angles to the crane the vehicle rotates about the centre point of the front axle. Super Model No. 20 is a particularly fine model, reproducing the essential features of these cranes, but differing from the original in that one Electric Motor is used for driving all movements. The different operations are controlled from the driver's position in the front of the model, and special features include an automatic switch for preventing overwinding of the jib, automatically-operated brake on hoisting shaft, and brakes on the luffing shaft and front road axle.

The Meccano model illustrated in Fig. 5 can be built with Outfit C, and its interest is greatly increased by the use of a *Magic* Motor for driving it. The method of fitting the Motor is shown in Fig. 4. It is bolted beneath the Flanged Plate, and drives the small castor at the rear of the crane by means of a rubber band passed round the Motor pulley, and round the special ½" Pulley that is supplied with the Motor, and can be seen (in Fig. 4) on the Rod of the 1" Pulleys. Owing to the method of drive employed, the castor cannot be made to steer the model. The jib is pivoted at 1 by locknutted bolts, and is controlled by a Crank Handle that carries a 3" Pulley serving as a brake. Cords from the Handle pass beneath two 1" Pulleys before being fixed to an Axle Rod at the lower end of the jib. The hoisting Rod is journalled in the Strips of the jib and carries a Bush Wheel used as a handwheel.

Readers whose range of parts will allow the construction of a bigger model, but not one so elaborate as the Super Model, should try building one on similar lines to the Super Model but modified according to the limitations imposed by the range of available parts. Even those having all the required parts should not be content to build the model exactly as shown in the Instruction Leaflet, but should carry out refinements and improvements as new ideas suggest. Similarly the builders of the small model will find its construction is much more interesting when they incorporate new ideas of their own.

Having built the types of crane illustrated the constructor should consider different types under the same heading. For instance, railway cranes are made in smaller sizes quite different from the big ones that are included in the breakdown train. By choosing a simpler subject it can sometimes be reproduced with greater accuracy with a limited number of parts.

There are other types of travelling crane too, and while some of these have not the great mobility of the one illustrated, they make interesting model subjects. Some of them can be adapted for use either as cranes or as mechanical excavators, thus greatly increasing their utility. To equip a model for use as an excavator a suitable bucket arm can be built up and pivoted to the jib, the bucket being fitted to the outer end. A Meccano Digger Bucket is suitable for models of small and medium size, and for large models a bucket can be built up of Strips and Plates. When the model is thus equipped the hoisting cord is attached to the bucket for raising and lowering it during excavating operations. The contents are tipped by releasing a bolt holding the hinged bottom, the bolt being operated by pulling on a length of cord.

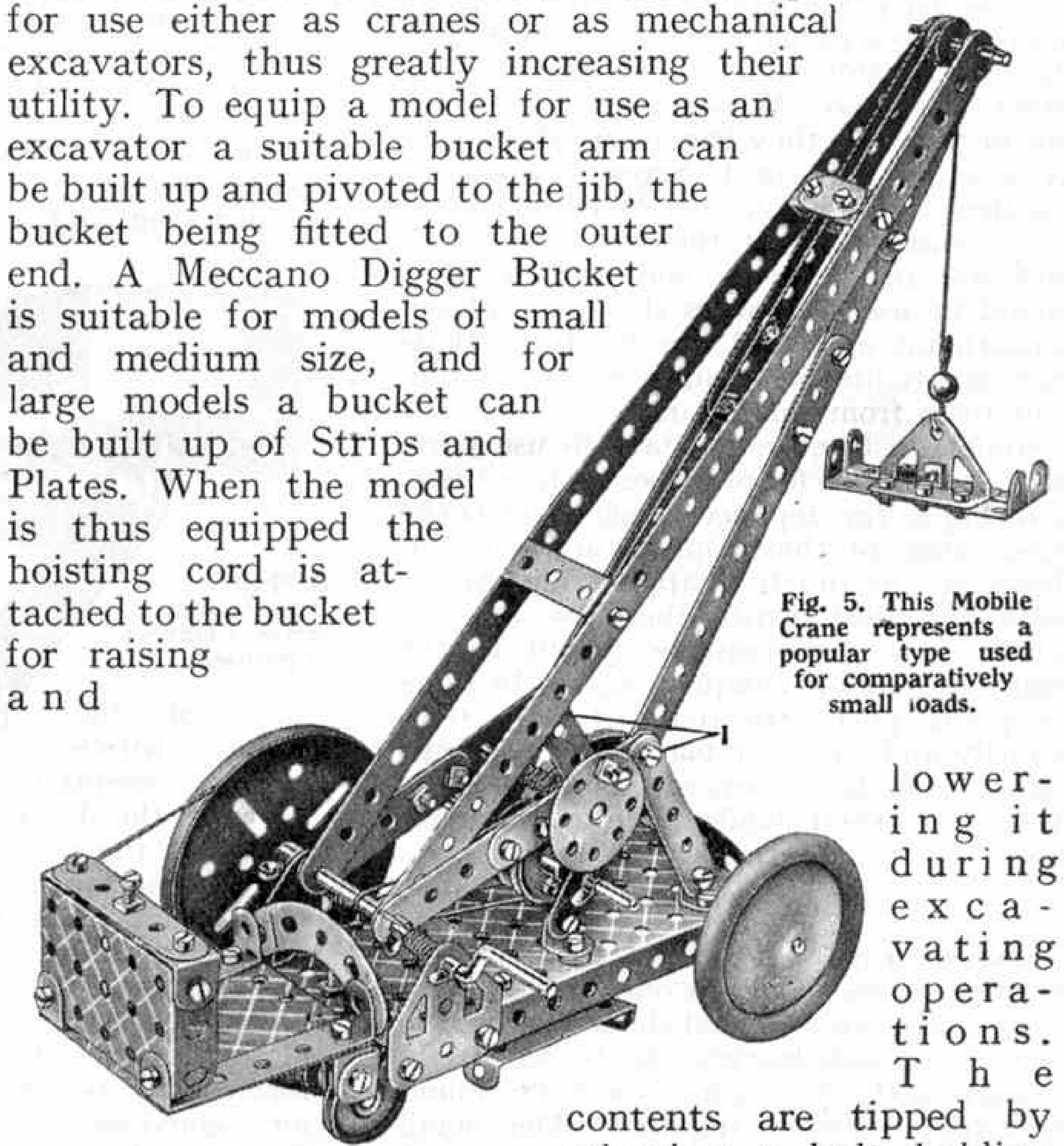


Fig. 5. This Mobile Crane represents a popular type used for comparatively small loads.

Domestic Gadgets in Meccano

A Few Hints to Model-Builders

USES for Meccano parts are not by any means confined to model-building, and the keen Meccano boy uses his Outfit to advantage for making many little fittings for his "den." All kinds of useful gadgets can be made to serve really practical purposes for improving comfort and convenience. The individual adaptability of Meccano parts makes them also particularly suitable for numerous odd purposes about the house, and they are specially useful in an emergency. With a little ingenuity broken articles can be repaired, or new ones improvised, by the use of appropriate parts, and often a sound repair can be carried out in this way to effect a big saving in the cost of a new article.

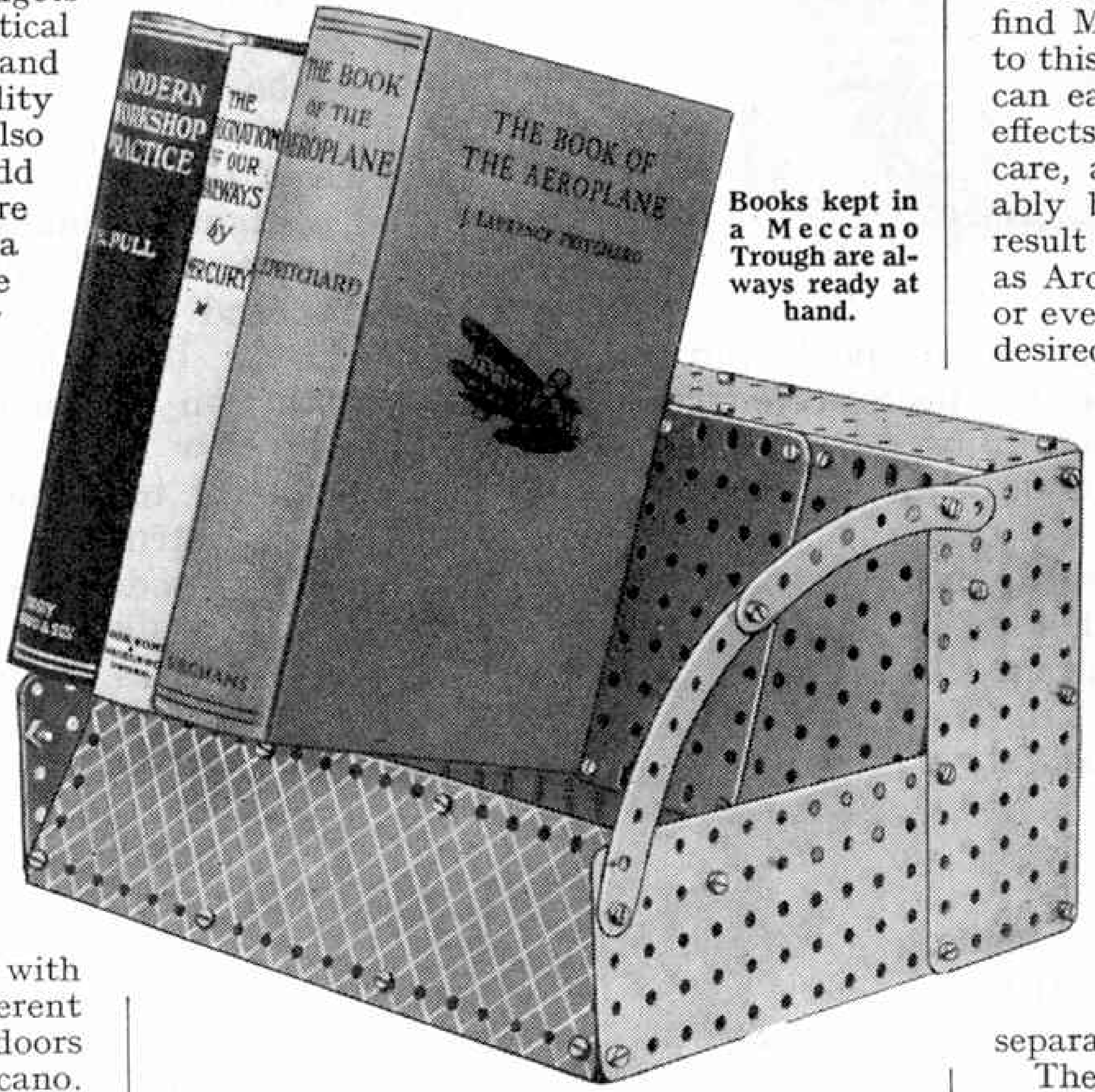
Meccano is useful to the woodworker and can be the means of saving much time in making small parts and fittings. For instance Hinges can be used for doors on small cabinets, and if necessary corners can be strengthened by Angle Brackets, Corner Brackets or Architraves. In addition to their uses for cabinets and box making, these parts can be applied in a large number of cases where it is desired to strengthen a right-angle. Angle Girders, too, can be used with success for similar purposes. Many different shapes and sizes of knobs for small doors and drawers can be made in Meccano. Parts that suggest themselves for this purpose are ½" and 1" fast Pulleys, Handrail Supports, and perhaps Collars, according to the special requirements. To secure these parts Meccano Woodscrews (No. 68) can be used, or they can be fixed in place by ½" or ¾" Bolts or 1" Screwed Rods. To use these Bolts in place of Wood Screws it is necessary to drill the wood to which they are to be fixed, and a 5/32" drill should be used. Washers should be placed beneath all nuts and the heads of Bolts that are tightened against wood, to prevent them from sinking in.

Some constructors hesitate to use parts from their Outfit for purposes such as these, as owing to the depleted range of parts the possibilities of their Outfits are reduced. However, the practical applications of the parts generally justify their use and, of course, new parts can be added to the Outfit to make it complete again. In some cases the parts are required only temporarily and can be replaced in the Outfit when they have served their purpose. It is often worth while buying new parts specially for a particular job.

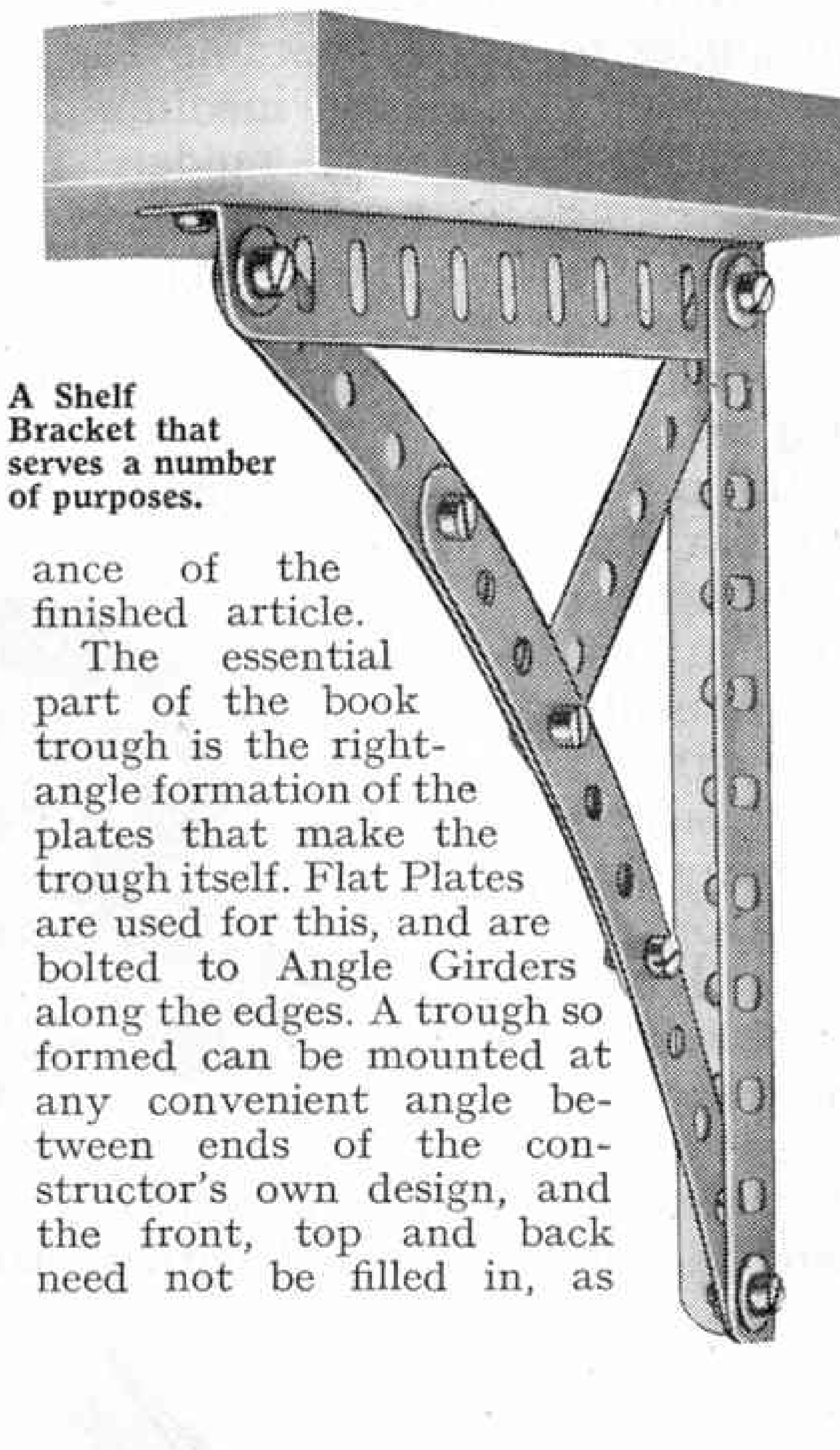
Book Trough

"Bookworms" who divide their interest between several books at once should build up a suitable rack to hold them when not in use. This avoids leaving the books in odd corners, and they can always be found immediately when required. The small book trough shown on this page is both attractive and useful.

The size of the trough will be governed by the average size of the books and the number that will be kept in it. The model illustrated is suitable for small and medium sized books and will accommodate up to half a dozen. It is 9½" long and is made up chiefly of Angle Girders and Plates. Such a subject as this can be built in various different ways according to the ideas of the constructor, and some very attractive results can be obtained. In building the model, the placing of the different coloured parts should be considered so that the colour combinations enhance the appearance of the finished article.



Books kept in a Meccano Trough are always ready at hand.



A Shelf Bracket that serves a number of purposes.

The essential part of the book trough is the right-angle formation of the plates that make the trough itself. Flat Plates are used for this, and are bolted to Angle Girders along the edges. A trough so formed can be mounted at any convenient angle between ends of the constructor's own design, and the front, top and back need not be filled in, as in the model illustrated.

A subject such as this offers much scope for artistic work. It can be built in an ornate style or of extreme simplicity, and those who favour ultra-modern designs will find Meccano parts particularly applicable to this sort of work. Any geometrical shape can easily be formed, but to get the best effects the parts should be chosen with care, and several arrangements will probably be tried before the most attractive result is obtained. For this work, parts such as Architraves, Trunnions, Girder Frames, or even Windmill Sails, often give just the desired effect, and some very pleasing designs can be produced. If the book trough is to be placed on a polished table it is advisable to stick small pieces of rubber or felt at the corners to prevent scratching.

Book Ends

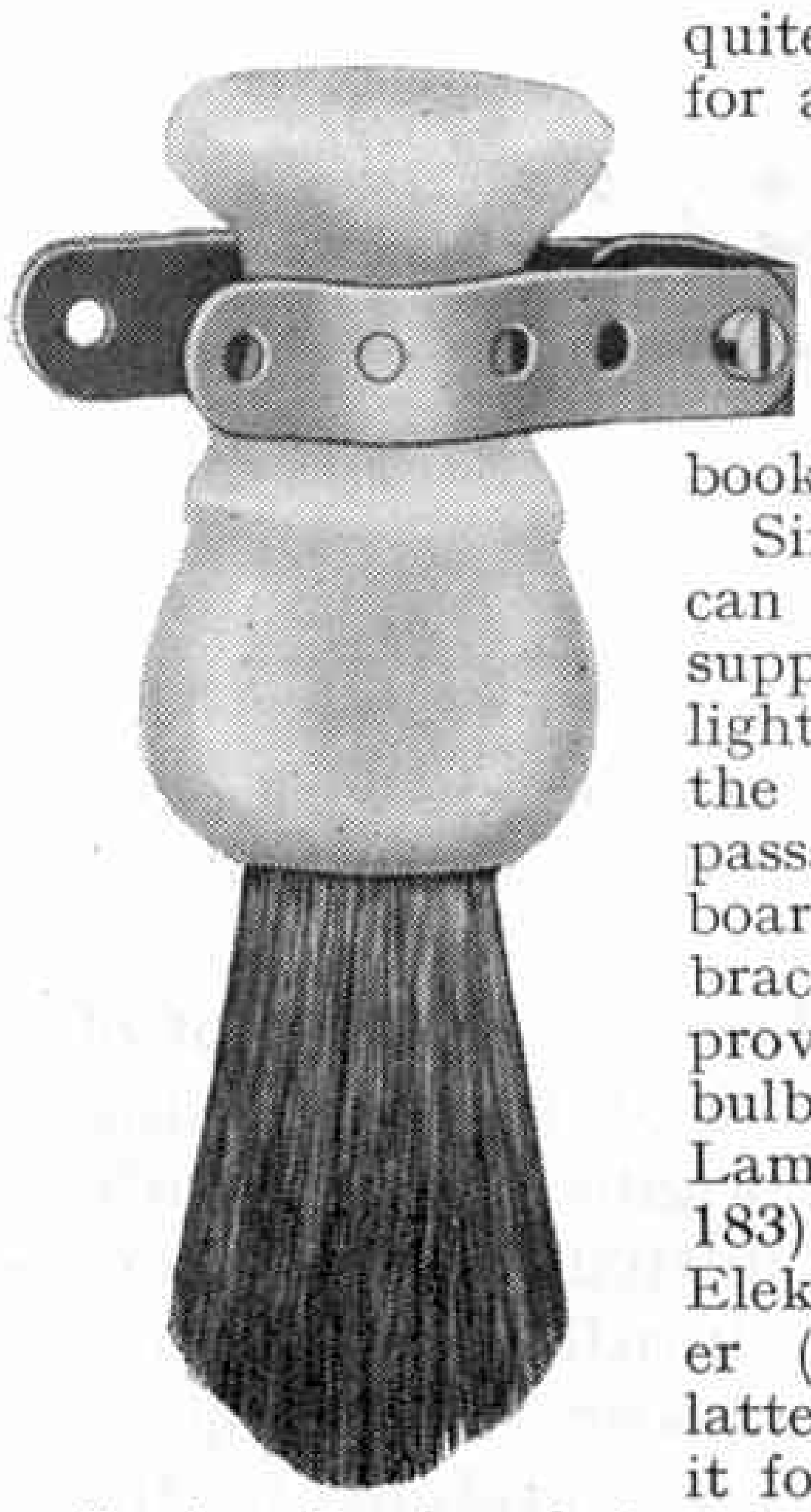
Book troughs such as the one illustrated are generally used for holding a few books only, although they can if necessary be made any size. However, it is often more convenient and more economical to use a pair of book ends for holding a long row of books upright on a shelf or table. Any number of books can be supported in this way by moving the book ends closer together or separating them according to requirements.

The simplest book ends are made by forming a right-angle of Plates. One arm of the angle is placed under the end books of the row so that the other arm is vertical and holds the books upright. Ends made in this way take up little room in use and are not costly to build.

More elaborate book ends can be made by adding ornamental work on the outside of the vertical Plates. Part of a model can be built up and made to project from the Plate, and a novel way of treating the subject is to build say a motor car or aeroplane in two sections so that the front of the model projects from one book end and the rear from the other. This gives the effect of the car or aeroplane driving or flying through the books! Cranes, locomotives, ships, etc., can all be reproduced in this form, or the ends may be of purely artistic design.

Shelf Bracket

This is a particularly useful device for fitting up a temporary shelf and can be used in other cases where rigid bracing is required for a right-angle corner. The great advantage in the use of Meccano for this purpose is that brackets of any size can be built with ease. The one illustrated is made up of two 5½" Angle Girders braced by 5½" Curved Strips and a 3½" Strip. Shelves of any length can be made by using two or more of these brackets for supporting a plank of the required dimensions. If great strength is necessary the supporting brackets can be made more rigid by duplicating the Angle Girders and using Angle Girders in place of the Curved Strips, but the construction shown will be found



Shaving Brushes last longer when hung by the handle.

quite strong enough for all ordinary purposes. Several shelves can be set up in this manner to make a set of book shelves.

Similar brackets can be made for supporting electric lights for fixing to the wall in dark passages and cupboards, etc. Each bracket would be provided with a small bulb screwed into a Lamp Holder (No. 183) or into the Elektron Lamp Holder (No. 1534). The latter is preferable as it forms also a small reflector. If a Transformer is available for lighting the lamps this can be accommodated in any suitable position and wired up to the lamps, which would be connected in series with a switch. To guard against the possibility of damage caused by a short circuit a fuse unit should be plugged into the Transformer. A Meccano switch can be built up, or the Elektron Switch (No. 1572) can be used.

Dry batteries serve as an alternative to the Transformer, and can be incorporated on the wall bracket itself, in which case the switch also would be fitted to it, making an entirely self-contained lamp.

Reading Lamp

A novel form of lamp for clipping to a book for illuminating the pages is illustrated. With a dry battery mounted in position there are no wires to restrict the movement of the book so that it can be taken wherever required. Those who take their books to bed for reading after "lights out" will find obvious advantages in this form of light.

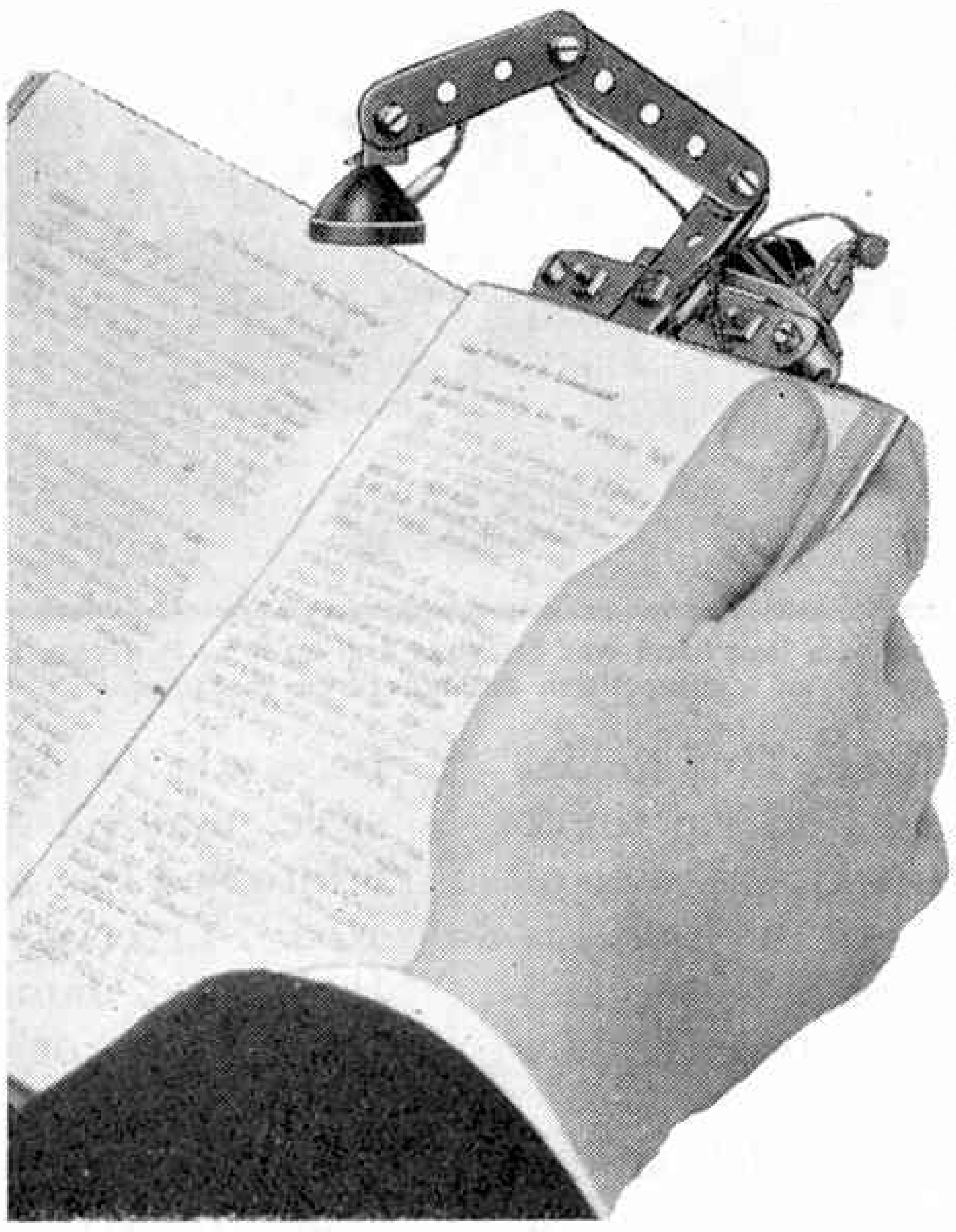
A standard 4½-volt flashlamp battery is used in this device, which is clipped to the back of the book by means of two 5½″ Strips. The Strips are spaced apart by two Washers on each of two bolts, one of which carries an Angle Bracket and the other a 3½″ Strip. The 3½″ Strip is bolted at right angles to the clip and a Threaded Boss is secured at each end. The battery is placed between the Threaded Bosses and another 3½″ Strip is clamped against the battery to hold it in position. The second Strip is held by two ¾″ Bolts screwed into the Threaded Bosses and provided with Washers that are secured by nuts to serve as knobs. To make allowance for the bolt head at the centre of the one 3½″ Strip, two additional bolts are secured on the Strip for the battery to rest against. A lantern from the Meccano Lighting Set is attached by its special bracket to a 2″ Strip fixed to the Angle Bracket on the clip by a 2½″ Strip. The Angle Brackets and Strips are joined together by locknutted bolts secured fairly tightly so that the parts remain in any set position. The locknuts prevent the pivots from working loose.

A pea lamp is used for illumination and is inserted in the slot in the lantern, which is provided with the clear celluloid disc. To avoid the flex from the lamp getting in the way it is wound several times round the battery and then attached to the terminals of the special battery clips supplied with the Lighting Set.

Watch Stand

Many practical uses can be found for the Meccano Lighting Set, and another useful application for the lanterns is shown in the Watch Stand illustrated. This simple model can be built with Outfit A with the addition of the Lighting Set, and its usefulness will be readily appreciated, especially during the dark nights and mornings of the winter. If placed within easy reach of the bedside the watch can be lit up to show the time at any hour.

Of course, it is not essential for the stand to be built up exactly as shown; in fact, most constructors will have their own ideas on how it should be made. The chief essential is the lantern, which should be carefully placed to light up the watch dial without casting a reflection in the glass. A simple push button switch is all that is necessary for the lamp, and can be devised from a Strip attached to a Plate by a 6 B.A. Bolt and insulated by Bushes and Washers. Another 6 B.A. Bolt should be fixed to the Plate directly beneath the Strip so that by depressing the Strip it touches the head of this Bolt and completes the circuit for the lamp. If an Elektron Outfit is available the Switch from this can be brought into commission as it is excellent for the purpose.



Battery and lamp are clipped on the book for lighting the pages.

Cycle Rear Lamp

By fitting the coloured discs in the lanterns several other uses can be found for them. For instance, with the red disc in a lantern a neat rear lamp for a bicycle can be made; or a stop light to show when the brakes are applied, thus warning following traffic to slow down. There should be no difficulty in fitting the lantern to the bicycle. It may be attached to one of the special brackets of the Lighting Set and bolted to a clip made of Strips for fitting to the seat stays of the bicycle, or the bracket may be attached direct to the bicycle carrier or some other convenient part.

For operating a stop light a clip can be made of Strips and attached to the handlebars so that as soon as the brake levers are moved to operate the brakes the electric circuit is completed for the lamp. The battery can be carried in the saddle bag, or a special box may be made and clipped to the frame to hold it.

Shaving Brush Clip

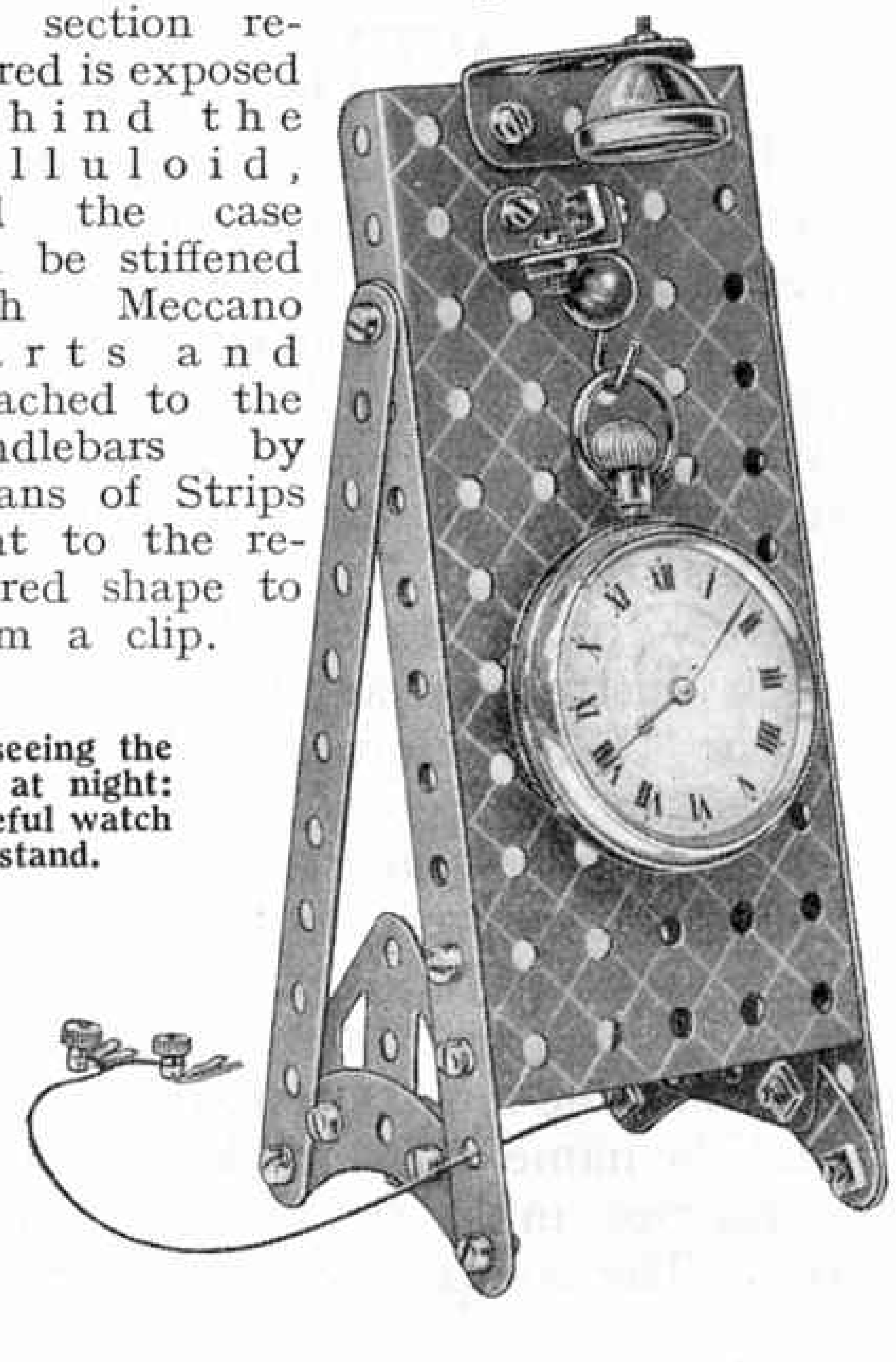
The simple clip shown at the head of this page helps to prolong the life of a shaving brush. After use most brushes are put away to dry standing upright on their handles; but instead of drying off, the water runs down the bristles to the head of the brush, eventually finding its way into the handle. When a brush reaches this stage it is perpetually damp. To avoid such a condition, and to keep the brush always fresh, it should be hung with the bristles downward, giving them a chance to dry off. To make the clip illustrated, two 2½″ Strips are slightly bent and fixed to a Double Bracket that is screwed to the wall.

To carry the idea further, a complete shaving stand can be made. This would support a mirror on adjustable mountings, with a clip for the brush and a place for the razor, and also for the hot water container. Yet another addition to increase the utility of the stand would be a small clip or hook for a tooth brush. Such a stand could be built up on a box-like base provided with a hinged front to make a convenient receptacle for tooth paste, shaving cream and razor, etc.

Accessories for Cyclists

Many uses for Meccano parts will occur to cyclists. A carrier can be made of Angle Girders and Strips, or an extra light one from Axle Rods and Couplings, and in the summer these carriers may be adapted for supporting pannier bags when camping gear is to be carried. A light frame built of Axle Rods and attached to clips at the top of the seat stays makes a useful support for a large touring bag suspended behind the saddle. Riders who like to have many gadgets on their machines can make a watch clip for fixing to the handlebars, and add a refinement by fitting a lantern for illuminating it at night. Those with good watches will be well advised to obtain cheap ones for this purpose.

Although many cyclists do little riding during the winter there are others who regularly cover long distances regardless of the weather. When on strange roads on a wet day it is awkward to refer to the map without its becoming soaked with rain, but this difficulty can be overcome by making a waterproof case for it and using clear celluloid for the front. The map is folded so that the section required is exposed behind the celluloid, and the case can be stiffened with Meccano parts and attached to the handlebars by means of Strips bent to the required shape to form a clip.



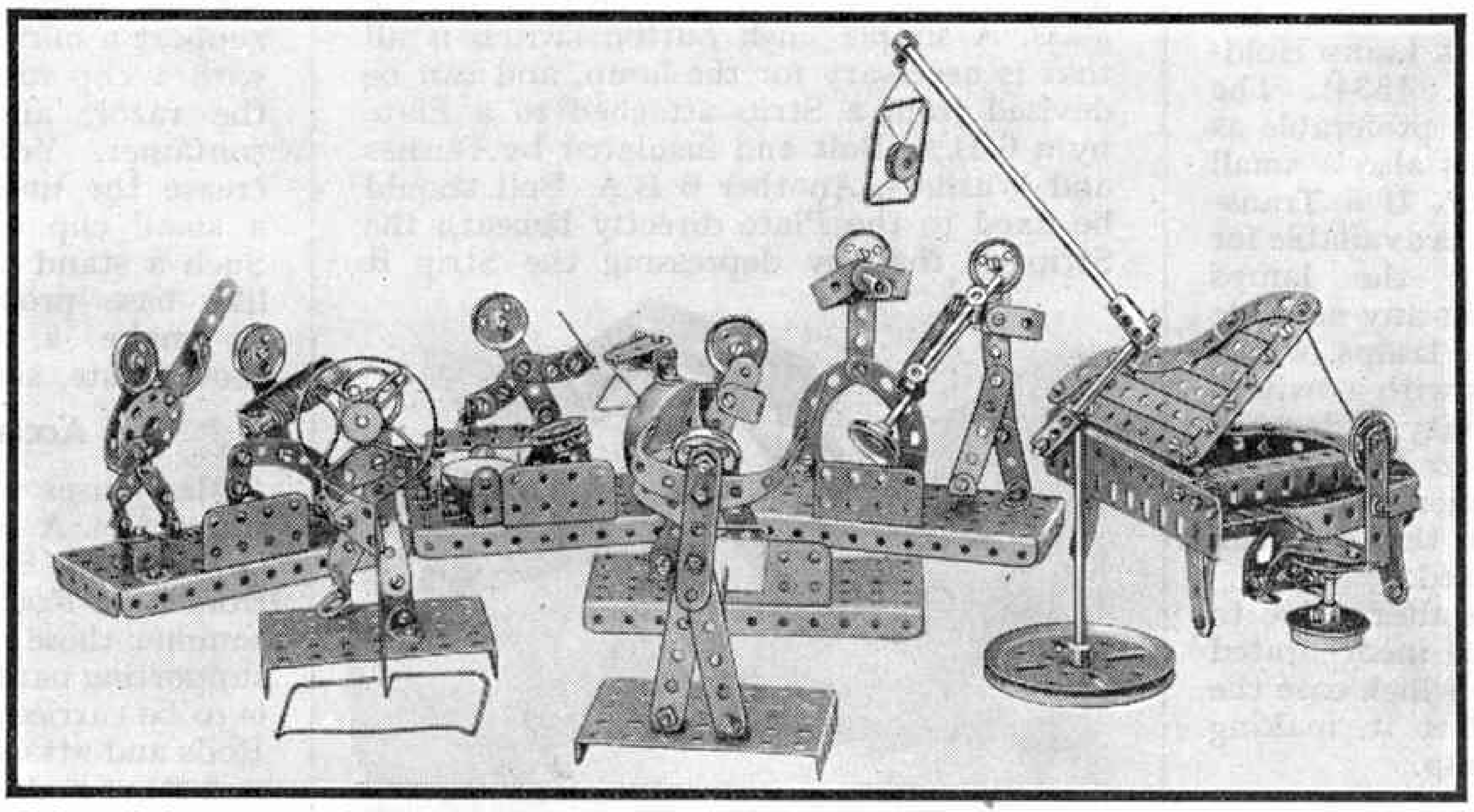
For seeing the time at night: a useful watch stand.

Grand "Christmas" Competitions

Cheques and Meccano Goods as Prizes

This month's model-building competition is organised more especially for the benefit of Meccano boys and girls who have only small Outfits, and fine prizes including cheques and Meccano goods are offered for the best models received.

The Christmas holidays will soon be here and the spirit of the festive season makes it a particularly appropriate time to indulge in model-building of a light or humorous nature. In the present competition therefore we are giving readers an opportunity to try their skill in making models of this kind. Competitors are asked to construct humorous models representing groups of people performing simple tasks. A typical example of what is required is the realistic jazz band group shown on this page. This model was built by a young Meccano enthusiast and we think readers will agree that he has obtained a striking degree of realism. One of the most attractive features of the model is the manner in which judicious adjustment of the Meccano Pulleys used as the heads of the musicians has resulted in a variety of amusing "expressions" on their faces.


This realistic representation of a jazz band was designed and built by P. Ryan, Leeds, and forms the basis of a competition announced on this page.

There is plenty of scope for the ingenious model-builder in designing and constructing models of this kind, and a valuable feature of such work is that it is not necessary to possess a large Outfit in order to build these models successfully. Very amusing models can be made with even the smallest Outfits, and in view of this I hope to receive a record number of entries.

The fine range of prizes listed in the panel at the foot of this page will be awarded for the most humorous and original models submitted. Competitors should therefore choose their subjects very carefully, for the more amusing a model is the greater will be its chance of winning a prize.

The contest is divided into two Sections as follows: Section A, for competitors of all ages living in the British Isles, and Section B, for competitors of all ages living Overseas.

When the entry is completed it is only necessary to obtain a photograph of it, or if this is not possible, make a good drawing and send it in an envelope addressed to "Meccanitian" Contest, Meccano Ltd., Binns Road, Liverpool 13. Competitors must take care to write their age, name and full address on the back of each photograph or drawing submitted.

Readers residing in Great Britain and Ireland must forward their entries not later than 31st January, 1936. In order to give Overseas competitors plenty of time in which to build and forward their entries the closing date for Section B will be 31st March, 1936.

"The Year's Best Prize Model" Voting Contest

In this Contest each competitor is asked to name on a postcard: (A) The prize-winning model he considers is the best illustrated in the "*M.M.*" during 1935; (B) the six models that he believes will prove the most popular, as decided by the massed votes of the competitors in this contest.

Only prize models that have been illustrated in any of the issues of the "*M.M.*" during 1935 are to be taken into consideration, including those prize models illustrated in this issue. Each model referred to must be identified by giving the page and date of the issue in which the illustration appeared and the name of the model.

Entries must be by postcard only. The competitor's name and address must be written on the card, which should be addressed to "Year's Best Prize Model" Voting Contest, Meccano Ltd., Binns Road, Liverpool 13. One entry only will be accepted from each competitor; any competitor who sends more than one entry will be disqualified.

There will be one Section only and readers living in any part of the world may enter. The closing date is 29th February, 1936. Prizes will be awarded to the three competitors who most accurately forecast the final results and details of these appear on this page.

In the unlikely event of two or more competitors placing the six models in the correct order, First Prize will be awarded for the neatest correct entry.

The Prizes Offered in These Competitions

"Meccanitian" Contest

A separate set of prizes as follows will be awarded in each Section:

1st Prize, Cheque for £3-3s.
2nd Prize, Cheque for £2-2s.
3rd Prize, Cheque for £1-1s.
Five Prizes of Meccano or Hornby Goods each value 10/-.
Five Prizes of Meccano or Hornby Goods each value 5/-.

"Year's Best Prize Model" Voting Contest

The prizes to be awarded in this competition are as follows:

1st Prize, Cheque for £1-1s.
2nd Prize, Cheque for 15/-.
3rd Prize, Cheque for 10/6.

Model-Building Competition Results

By Frank Hornby

"Summer Realism" Contest (Home)

The lists of awards in the Home Section of the "Summer Realism" Competition are as follows:

Section A (Competitors over 14)

First Prize, Meccano or Hornby Goods value £3-3s.: H. Kelk, Staplehurst. Second Prize, Goods value £2-2s.: J. Hunt, Epsom, Surrey. Third Prize, Goods value £1-1s.: F. Whiteley, Manchester.

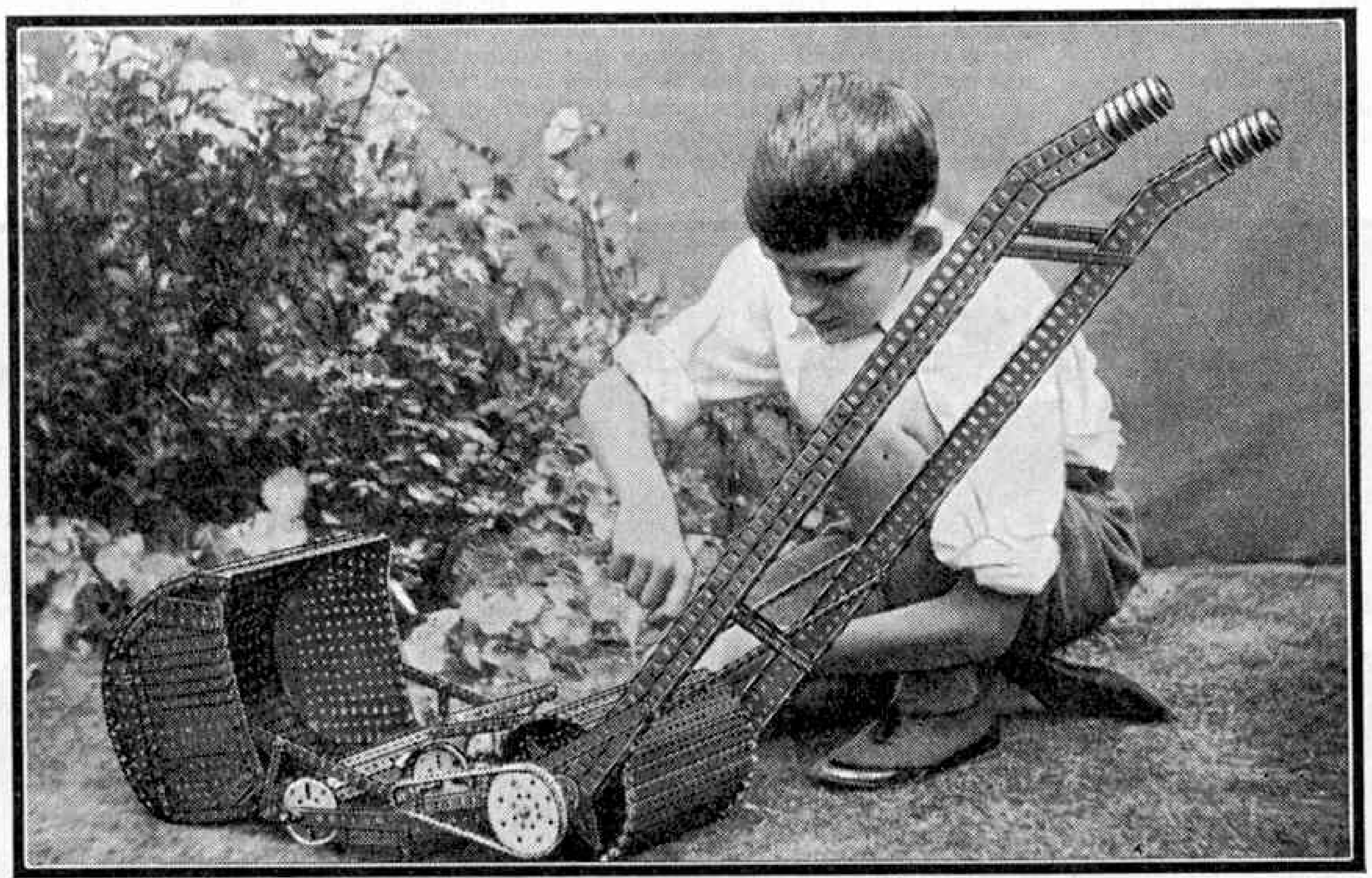
Meccano or Hornby Goods value 5/–: F. Jones, London, S.E.5; P. Lea, Shifnal, Shropshire; M. Lightfoot, Carlisle; C. Parker, Hove; R. Thomas, Birmingham.

Section B (Competitors under 14)

First Prize, Meccano or Hornby Goods value £2-2s.: P. Ward, Bromley. Second Prize, Goods value £1-1s.: P. Bunce, Harpenden. Third Prize, Goods value 10/6: E. Clements, Farnborough.

Meccano or Hornby Goods value 5/–: B. Clark, London, S.E.21; V. Gibson, Lydney, Glos.; G. Gillespie, Peterborough; P. Lewis, Totton, Hants., W. Woodend, Barrow-in-Furness.

A rather surprising feature of the competition is that many of the entries submitted by competitors under 14 years of age are undoubtedly much better both in originality and construction than those submitted in the Section for older boys. I was pleased to see, however, that some competitors had taken considerable trouble to arrange realistic settings for their models, and in this respect I think that the entries in Section A are the better.



A fine Meccano model lawn mower and its builder E. Clements of Farnborough, photographed in a realistic setting. This entry was awarded Third Prize in the "Summer Realism" Competition.

H. Kelk won First Prize in Section A with a model arch bridge that he set up over a river flowing in a miniature valley. Some sailing boats are to be seen on the water and on the bridge itself several vehicles are shown. The bridge was not built specially for the purpose of this competition but was constructed some time ago as a permanent feature of an outdoor railway layout, in which it is used to carry the track across an artificial stream. Including the approaches, which are made of concrete, the total length of the bridge is 30 ft. and it weighs 1,380 lb.

The model that won Second Prize for J. Hunt is a crane, and in the photographs submitted it is shown hoisting small blocks of stone. The model is set up in surroundings consisting of rocks and vegetation arranged to represent a quarry.

F. Whiteley who won Third Prize sent a photograph showing a mechanical shovel at work in a gravel pit. Although this competitor took great care to ensure that the model itself was as realistic as possible, the setting in which it was incorporated might have been considerably improved with very little trouble.

First Prize in Section B was awarded for a cleverly arranged scene showing a lumber camp with a traction engine busy hauling a trailer loaded with giant logs. A considerable amount of detail is included in the background and this makes it very attractive and realistic.

Second and Third Prizes in Section B were won by entries of a similar type, which were submitted by P. Bunce and E. Clements respectively. In each case the model is a full size lawn mower, and it is shown at work in the garden. The model constructed by E. Clements is shown on this page and its constructional details are very similar to those in P. Bunce's model. The roller is made from 12½" Strips bolted round the rims of Hub Discs, and as the machine is pushed along the roller drives the cutting cylinder through Sprocket Chain. The cutting cylinder is made by 12½" Strips bolted to 3" Pulley Wheels, the Strips being twisted to give the correct contour. The spindles of the roller and the cutting cylinder are journalled in reinforced bearings made from Double Arm Cranks bolted to Angle Girders that form part of the framework. Two Boilers mounted on a Rod in the front of the model hold the cutting cylinder slightly above the level of the ground.

A well arranged scene representing a crash between a loaded goods train and a passenger train won a prize for C. Parker. In the photograph I examined the Hornby locomotive of the passenger train is shown derailed and in the process of being lifted back on to the track by a large Meccano travelling breakdown crane.

"Engineering of the Past" Competition

The full list of prizewinners in the "Engineering of the Past" Contest (Home Section) is as follows:

Section A

First Prize, Meccano or Hornby Goods value £2-2s.: W. Trenholm, Eaglescliffe, Co. Durham. Second Prize, Goods value £1-1s.: E. Hedges. Manchester. Third Prize. Goods value 10/6: G. Patterson, Manchester 8.

Goods value 5/–: J. Kennett, Richmond, Surrey; J. Matthews, Fillongley, Nr. Coventry; A. Mould, Tipton, Staffs.: L. Summers. Birmingham 7; C. Williams. Manchester 11.

The model that pleased me best is a locomotive built by W. Trenholm, and which was awarded First Prize. It reproduces an engine designed in 1837 by William Norris, a famous locomotive designer. The model has a tall funnel, four front bogie wheels, two large driving wheels and four wheels to carry the tender. The model is 19 in. long and 8½ in. high to the top of the chimney.

A biplane of the type flown by the Wright Brothers in 1905 forms the subject of the model submitted by E. Hedges. The model has a wing span of 2 ft. and a length of 1 ft. 5 in. The upper mainplane is made from 12½" Strips with 5½" Strips bolted across them.

May "Aeroplane Constructor" Contest

The competition for models built from the Meccano Aeroplane Constructor Outfits, which was announced in the May 1935 issue of the Magazine, attracted a large number of entries, and many competitors showed considerable ingenuity in using the various parts contained in the Outfits. The full lists of awards in the competition are as follows:

Section A (Home competitors)

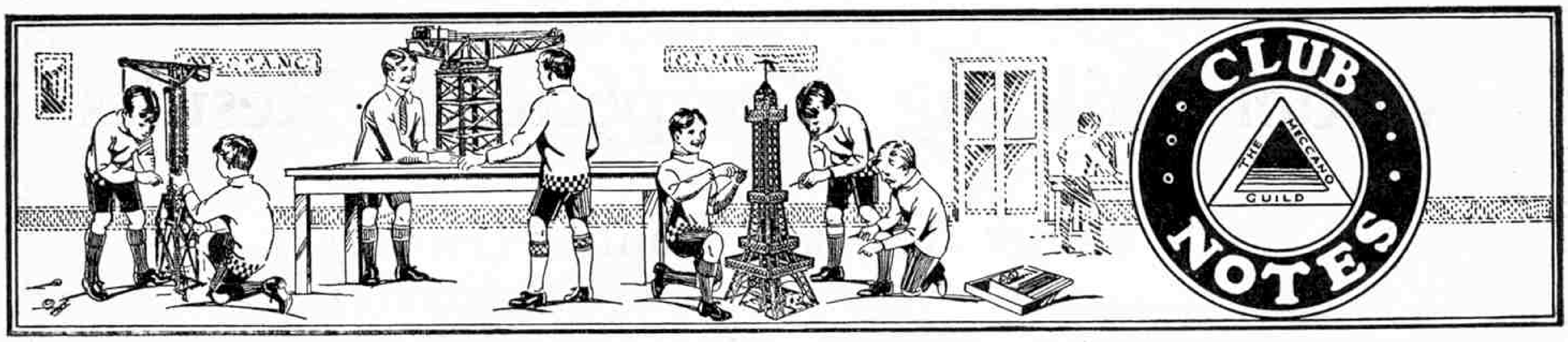
First Prize, Meccano or Hornby Goods value £1-1s.: R. Millett, Markfield, Leics. Second Prize, Goods value 15/–: D. Patterson, Manchester 8. Third Prize, Goods value 10/6: C. Hickman, London, S.E.15.

Meccano or Hornby Goods value 5/–: P. Baldwin, South Merstham, Surrey; L. Bridgeman, Woodford Green, Essex; E. Martin, Belfast; H. Noverraz, Glasgow. W.3; T. Patten, Leith.

Section B (Overseas competitors)

First Prize, Meccano or Hornby Goods value £1-1s.: Too Chee Kong, Kuala Lumpur, F.M.S.. Second Prize, Goods value 15/–: D. Hofsommer, The Hague, Holland. Third Prize, Goods value 10/6: F. Aria, Bombay 7, India.

Meccano or Hornby Goods value 5/–: P. Blight, Killora, Australia; B. Westropp, Mirzapur, India. D. McLeod, Natal, South Africa; R. Myburgh, Capetown, South Africa; B. Stoderberg, Falun, Sweden.

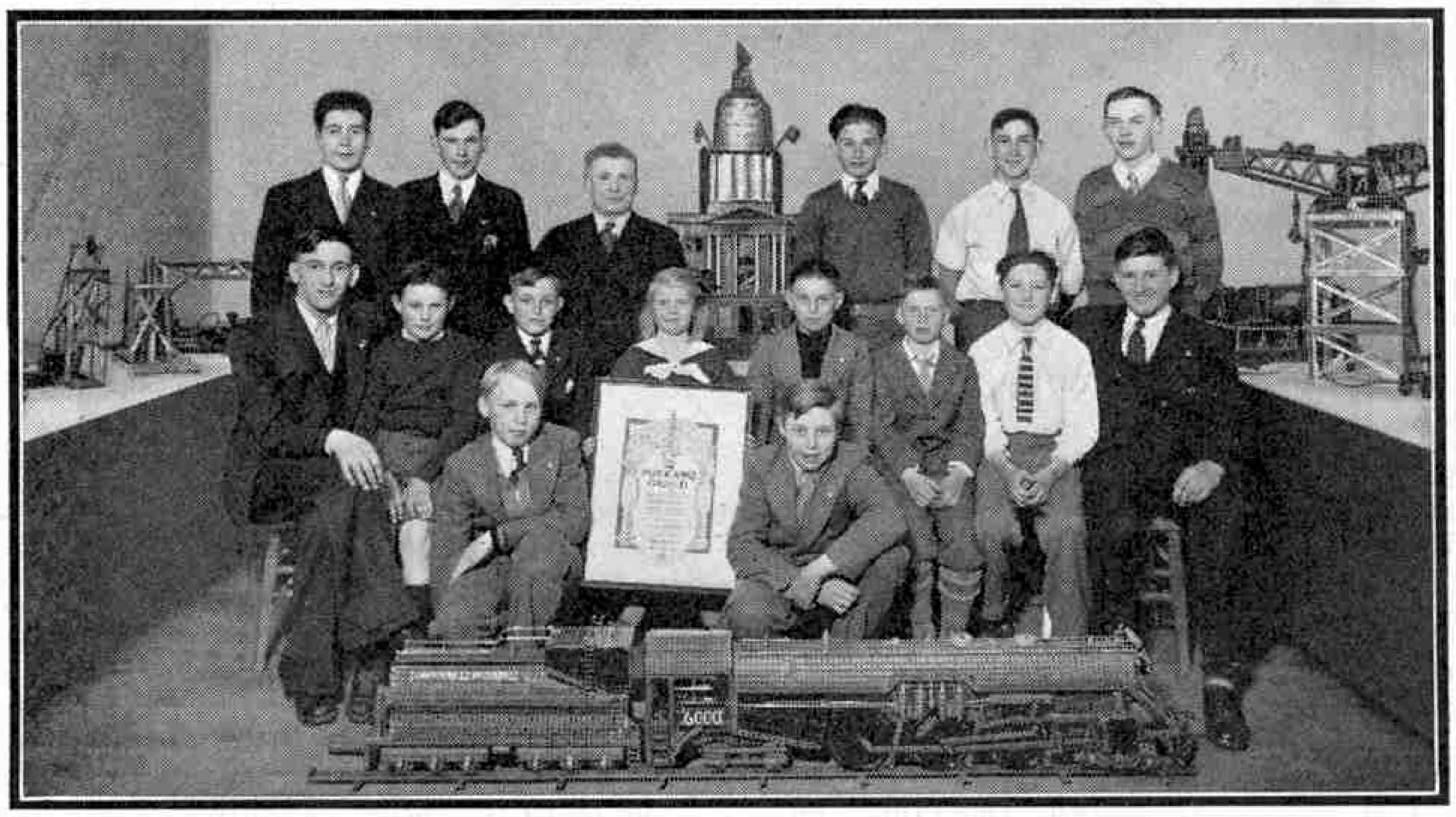


Queen Elizabeth's Grammar School (Barnet) M.C.—The excellent programme now being carried out has so far included a visit to the L.N.E.R. Locomotive Sheds at Barnet, and Lantern Lectures on "*The Story of London Traffic*"; "*The Countryside of London*" and "*The Future is in the Air.*" An interesting Talk on Bees has been given by H. C. Francis, Esq., an Old Boy of the school. The session is to be concluded with a Grand Exhibition, for which models are being hired from Headquarters to augment the club display. Club roll: 80. *Secretary:* E. J. Mansfield, "Norfield," 25, Hillside Gardens, Barnet, Herts.

Fraserburgh M.C.—This club has now become affiliated with the Meccano Guild and is making good progress. A successful Autumn Exhibition raised the club funds by £2 10s. 0d. Visitors to the Exhibition were entertained to tea by the members, who provided the refreshments. A Junior Section has been started. The club library has a good stock of books, and is much appreciated. The members are grateful to Mr. William Ritchie, of Rosehearty, for the gift of trestle tables. Club roll: 16. *Secretary:* T. Smythe, Central Schoolhouse, Fraserburgh.

Holborn Senior Boys' School M.C.—It is gratifying to report that most of the members who left the school last July are still attending club meetings, and they have been very helpful in giving advice and assistance to the younger and new members. The chief feature of recent Model-building Evenings has been the construction of a large model of the Quebec Bridge. A visit has been paid to the works of the Ford Motor Co. at Dagenham. Club roll: 30. *Secretary:* L. Phillips, 58, Wigston Road, Plaistow, London, E.13.

Corner House (Corsham) M.C.—Interesting Lectures by the President and members are being given during this session. At a recent Model-building Evening members had to construct a model of a train from parts laid out, and as the job had to be done in a stated time everybody was very energetic! Hornby nights are held once a month, and provide an agreeable contrast to model-building activities. Club roll: 12. *Leader:* Mr. G. Dyke, Corner House, Church Street, Corsham.


A group of officials and members of the Rosemount (Regina) M.C. Mr. J. T. Favelle, President and Leader, is third from the left in the back row; on his right is Mr. J. E. Watson, secretary. This Canadian club was affiliated in August, 1932. The fine models displayed at a recent Exhibition were the subject of complimentary references in the local press.

St. Stephen's (Saltash) M.C.—Electric lighting has been installed in the school, and the club has benefited along with the other departments. The two groups of members co-operated in building a large model Fair. When it was completed the various roundabouts, etc., were set in motion, and the result was declared to be most realistic. A successful Dance has been held, and the moderate charge made for admission enriched the club coffers by £2. Club roll: 16. *Secretary:* A. Jackson, 5, Jubilee Cottages, St. Stephen's-by-Saltash, Cornwall.

St. Columba's (Sunderland) M.C.—The club has been revived, and under the direction of new and enthusiastic officials is making excellent progress. Great interest was taken in the building of a model of the Eiffel Tower, and this was exhibited, along with many working models built by members, at the Church Bazaar. An attractive Winter programme is being carried out, and a recent innovation that is already very popular is a Physical Training class. Club roll: 25. *Secretary:* R. Howe, Carley Road, Southwick, Sunderland.

Plymouth M.C.—An invitation to exhibit models at a local bazaar last month was accepted, and the display arranged by members provided excellent publicity for the club. Model-building Evenings are being relieved by occasional Lantern Lectures. The club has decided to produce its own Magazine, and a very efficient printing section has been formed for this purpose. It has already printed some neat handbills. Club roll: 69. *Secretary:* R. G. Symons, 47, Lisson Grove, Mutley, Plymouth.

Old Charlton M.C.—On Model-building Evenings members who possess only small Outfits are now given an easier model to build than members with more equipment. For example, on one occasion the chosen models were a windmill and an excavator respectively. The new arrangement has met with general approval, as members with small Outfits no longer feel at a disadvantage. Club roll: 20. *Secretary:* W. Jaques, 60, Gurdon Road, London, S.E.7.

Kendal M.C.—A club-room has not yet been found, but in spite of this handicap the members have a very enjoyable time. The Leader took some of them in his car to Blackpool to see the Illuminations, and a thrilling time was spent there. One member has a model yacht and recently the club accompanied him to Morecambe to join in sailing it on the boating lake. The yacht provided great fun until it grounded near the side, and the owner had to hitch up his trousers and wade in for it! Several members have visited the Lancaster Branch of the H.R.C. and have been impressed by the keenness of the members there. Club roll: 10. *Leader:* Mr. L. Haslam, Middleton, Kirkby Lonsdale, Carnforth.

Middlesbrough M.C.—This club is now divided into five sections called the "Aeroplane," "Ship," "Motor Vehicle," "Locomotive" and "Junior" sections respectively. The Locomotive Section meets once a month, and interesting train operations and locomotive speed trials are then carried out. The Junior Section was formed under the guidance of the Leader, and is making steady progress. Energetic recruiting is going on to increase the membership. Club roll: 40. *Secretary:* L. Shepherd, 29, High Street, North Ormesby, Middlesbrough.

Sutton Valence Council School M.C.—Interesting competitions are adding to the general enjoyment of model-building meetings. Certain evenings are devoted to chemistry and electrical experiments. The club football team is in good form and its ambition is to defeat the rest of the school. Club roll: 19. *Secretary:* J. Chandler, "Herriard," Chart Sutton, Nr. Maidstone.

Regent Street Central School (Heywood) M.C.—There has been a big increase in membership this session and all meetings are well attended. Recent lectures have included one by Mr. Chaplin, the Leader, on the various activities of the school; a lecture on "*The Preservation of the Countryside,*" and one on "*Malta*" by a gentleman who has visited the island. Games are played on certain evenings, and in a recent Draughts Contest the club beat the school by six matches to four. Preparations for a club Exhibition are well in hand. Club roll: 150. *Secretary:* R. Nobbs, 2, Barker Street, Broadfield.

Enfield Grammar School M.C.—The club has been re-organised and is now divided into four Sections, three of which have been busily engaged in building models of Watt's Beam Engine, the Meccanograph and of a Lift Bridge. The fourth Section has been concentrating on assembling the club track. Meetings have been held on several evenings each week in order to complete the work in hand in time for the club Exhibition to which members are looking forward eagerly. Club roll: 30. *Secretary:* J. H. Pettifer, 31, Goat Lane, Forty Hill, Enfield.

Sid Vale M.C.—The fifth annual Exhibition was a great success. The display covered nine stands, and included models of a fully equipped Aerodrome; a Workshop in which electrically-driven shafting operated a remarkable array of machines; a Timber Mill; and a Fairground complete with roundabouts, traction engines and side-shows, all illuminated and working. A model of Buckingham Palace was lent by the Exeter M.C., and attracted much attention. One table of which members were specially proud was occupied by a display of Medallions, Certificates of Merit and Silver Cups won by the members. Club roll: 20. *Secretary:* L. R. J. Gliddon, Sheffield House, Sidmouth.

CANADA

Toronto Central Y.M.C.A. M.C.—Several models built by members were entered in the Broadview Boys' Fair, to which an interesting visit was paid by the club. Mr. Geldart has been compelled to relinquish Leadership of the club, and it is hoped that a successor will soon be found. The club room has been "spring" cleaned and made brighter, and is now the scene of regular and attractive meetings. Club roll: 12. *Secretary:* W. B. Moore, 141, Albertus Avenue, Toronto 12, Canada.

NEW ZEALAND

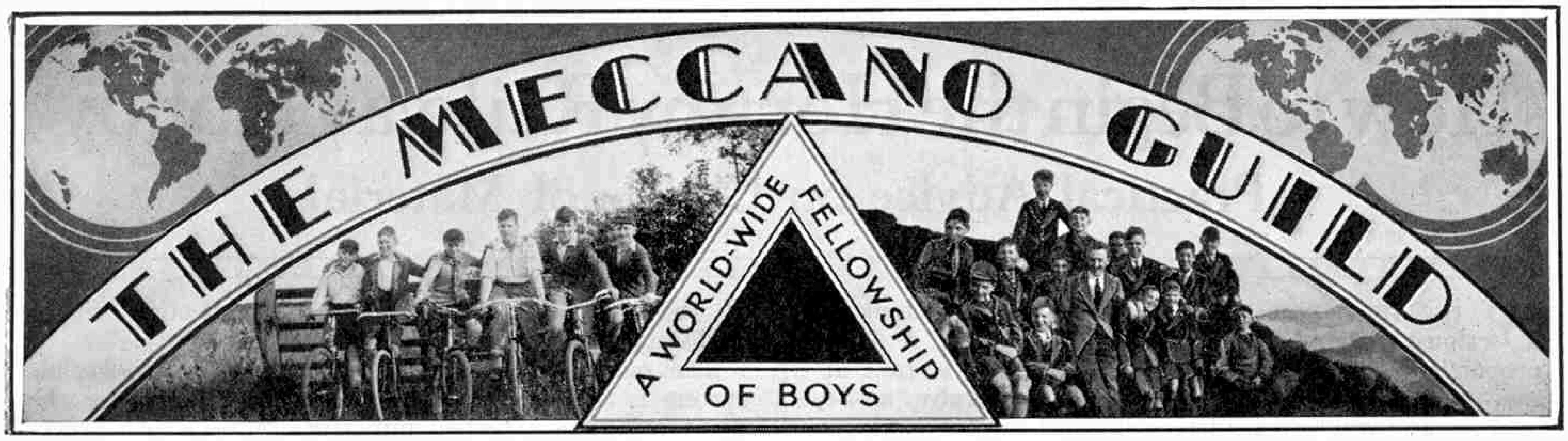
Christchurch M.C.—Lantern Lectures on "*Northumberland*" and the "*Mersey Tunnel*" have been greatly enjoyed. At one meeting the club welcomed K. J. Orams, secretary of the Blenheim M.C., who was visiting Christchurch. He could hardly have chosen a better time to call, as it was a "mystery" evening, during which many new games were played. The meeting was rounded off by an impromptu supper of cocoa and biscuits, which, in the words of the club secretary, "went off well!" Several members exhibited models at the Canterbury Winter Show. During school holidays the club programme consisted mostly of interesting Rambles, Cycle Rides and Visits to Works. Club roll: 22. *Secretary:* L. W. Best, 28, Circuit Street, Strowan, Christchurch, New Zealand.

SOUTH AFRICA

Pioneer M.C.—A recent Contractor's evening proved very exciting. The Committee asked for tenders for a Mechanical Shovel, and specifications submitted had to include the names and quantities of the Meccano parts required. The contract was given to the member whose tender was the lowest, but in spite of his best efforts he failed to construct the shovel in the time stated in his tender! A. Easthope won the competition by completing his model of the shovel in five minutes less than the contract time. Members have expressed appreciation of their continued correspondence with Meccano boys in other parts of the world. Club roll: 12. *Secretary:* A. H. Alley, 461, Burger Street, Pietermaritzburg, Natal, S. Africa.

Clubs Not Yet Affiliated

Tudor (Hanworth) M.C.—Members have been busy decorating the hut, in which meetings are held weekly. The locomotives, rolling stock and track of the club have also been overhauled. A recent Draughts Competition was very popular. Club roll: 6. *Secretary:* R. H. M. Vere, Lynton, Queensway, Hanworth, Middx.


THE MECCANO GUILD
A WORLD-WIDE FELLOWSHIP OF BOYS

Christmas Greetings!

I always look forward to beginning my December notes, for they give me the pleasure of wishing a Merry Christmas to all members of the Guild and of Meccano Clubs throughout the world. My mail during this month will bring me many reminders that my greetings are reciprocated by thousands of Meccano boys in practically every civilised country. I hope that everybody connected with the organisation will thoroughly enjoy the festive season, and I look forward to hearing of good times spent in Christmas gatherings in the homes of members and in club rooms.

Each year the Guild becomes more firmly established, for Meccano has a wonderful power of bringing boys together. The common enjoyment of the hobby seems to be the surest means of establishing genuine and lasting friendships, and it would be difficult to find a more pleasant sight than that of a group of Meccano boys at work or play.

Best Time for Recruiting

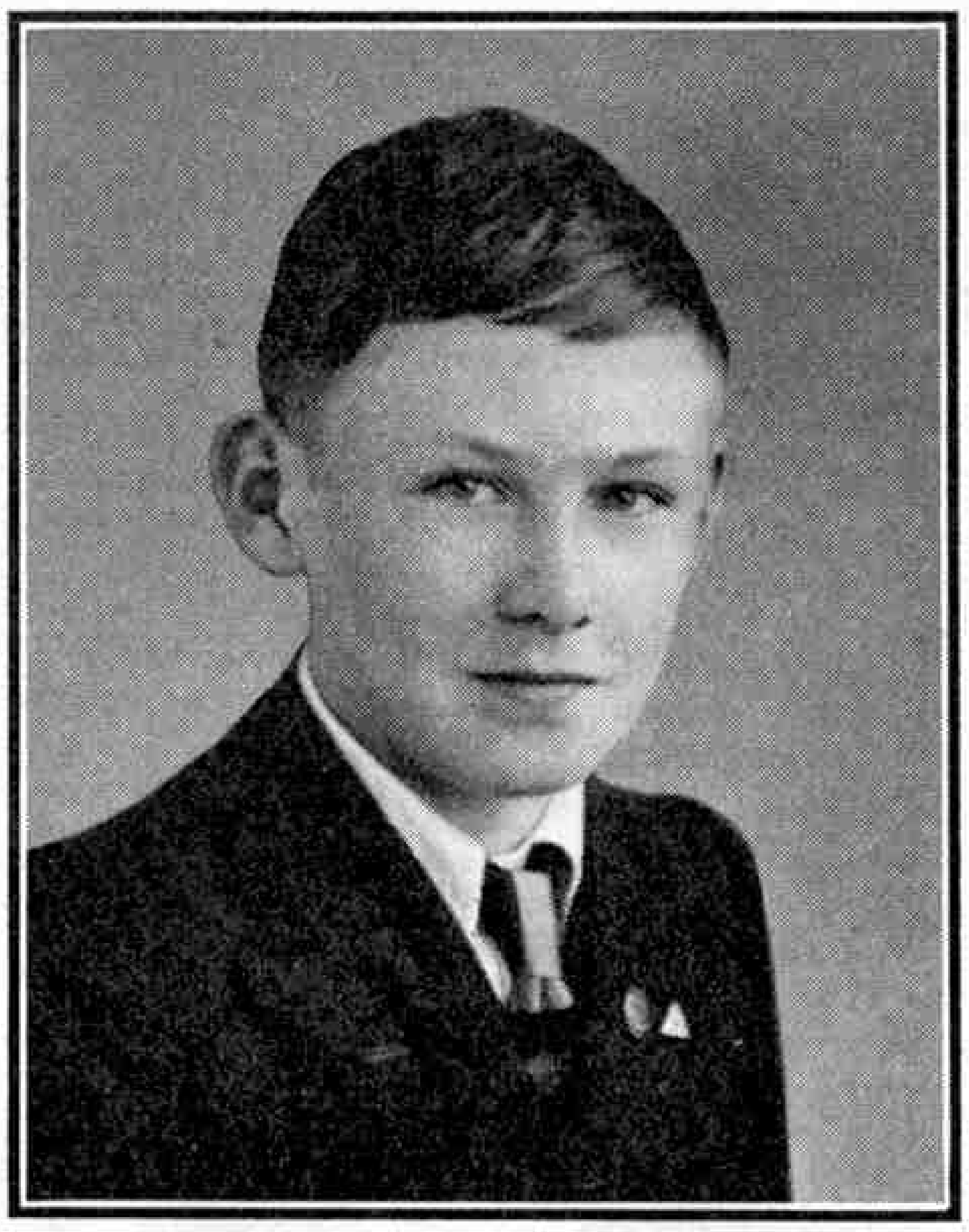
The Christmas season is the happiest time of the year in a Meccano Club because it brings leisure days in which members can indulge in their favourite hobby. Most of them have probably had the good fortune to receive additions to their stock of Meccano, and in conjunction with their fellow enthusiasts they enjoy the thrill of building larger models than they have ever made before.

It is also an ideal time to enlist the aid of new and enthusiastic members, recruited from the great army of Meccano boys who first take up the hobby at this season and are eager to realise how to make use of their newly acquired Outfits to the best of their advantage.

In every Meccano Club throughout the world, therefore, plans should be made to give a cordial welcome to beginners. There is no need to carry on an elaborate recruiting campaign, as satisfied members are the very best agents for a club. If every member determines to persuade at least one new Meccano boy to join the club the result will truly be great.

Meccano Club Secretaries

No. 35. T. W. A. Smith



T. W. A. Smith is secretary of the Exeter Meccano Club, a flourishing organisation affiliated in April 1925. Model-building is carried on extensively and Contractor's Nights are a special feature of this branch of the club's activities. An excellent Costing system has been introduced in connection with them, and a system of "points" covering materials and construction involved has been worked out.

The D.M.A. Co. Booklet

Many Leaders and secretaries have written to me conveying the disappointment of members at not having received the promised illustrated booklet of speed records from the D.M.A. Co. Ltd. I have made enquiries, therefore, and I am given to understand that distribution has been postponed until early next month.

The edition of the booklet available when I wrote to Leaders and secretaries in October contained a record of 1935 speed achievements up to that time, and therefore was incomplete as a record for the year. A new edition is to be printed in January, and this will include details of racing accomplishments during the period since the first edition.

The D.M.A. Co. Ltd., felt that members would much prefer the complete booklet rather than the incomplete first edition, and when the booklet does reach them I am sure they will find that it has been well worth waiting for.

Special Merit Medallions

Each February I publish on this page the names of members of Meccano Clubs who have been awarded Merit Medallions during the past year. This list is always an impressive one, but sometimes names that might have been included are omitted because Leaders have, for one reason or another, informed me of them too late. The members whose names are put forward at the last minute receive their awards like those nominated earlier, of course, but it always seems to me a pity that this opportunity of "broadcasting" their achievement should be missed.

I ask Leaders, therefore, to send me their nominations as soon as possible, especially those who desire to present the Medallions at Exhibitions or Social Meetings held during the Christmas and New Year holiday season, for the Medallions must be suitably engraved before being despatched from Headquarters.

There are yet many clubs in which full advantage is not taken of this means of rewarding good work by members, and I am looking forward to receiving recommendations from the Leaders of them. As I have mentioned before, there are no restrictions in regard to the nature of the services for which the Merit Medallions may be awarded, and two are available each session to every affiliated club. The Medallions are always greatly appreciated by the members who receive them.

Planning the Second Winter Session

The first of the two winter sessions ends in a few weeks' time, and the officials of clubs will then have an opportunity of taking stock of the events of the session. In this matter, as in so many others, there is scope for co-operation with the ordinary members, and the Leader or Committee should devote at least a part of the final meeting to talking over with them each item of the programme that has been followed. They will then have the definite views of the members for guidance in drawing up an interesting programme for the second winter session.

Proposed Clubs

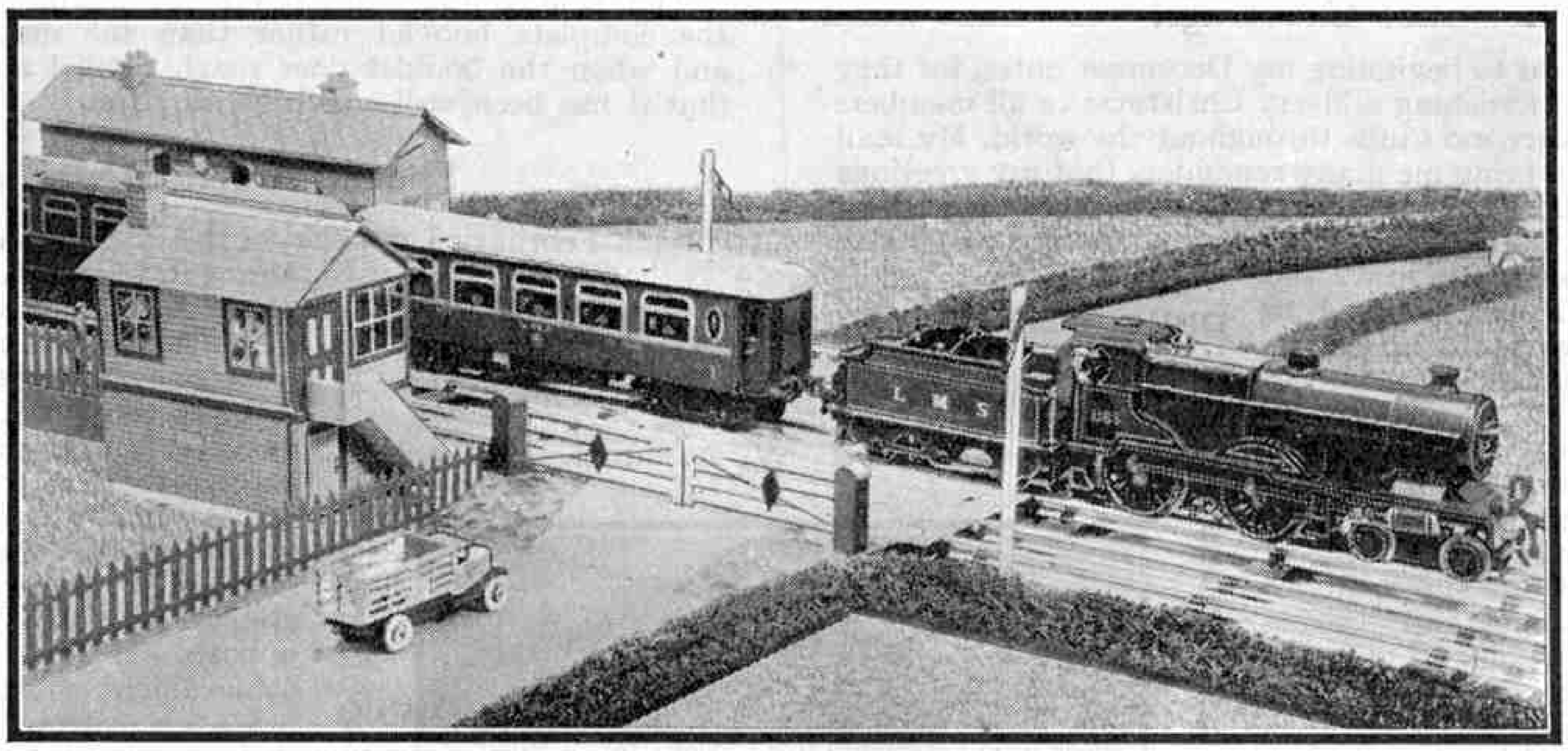
Attempts are being made to establish Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:

INDIA—P. Foster, 85, Barrack Road, Barrackpore, Bengal.
NELSON—T. H. Yoxall, 76, Carleton Street, Nelson.
TROWBRIDGE—James Bros. (Wilts) Ltd., The Parade.
WEYMOUTH—R. S. Hownam-Meek, Old Castle Cottage.

How to Begin the Hornby Railway Hobby

Practical Advice on Choice of Material

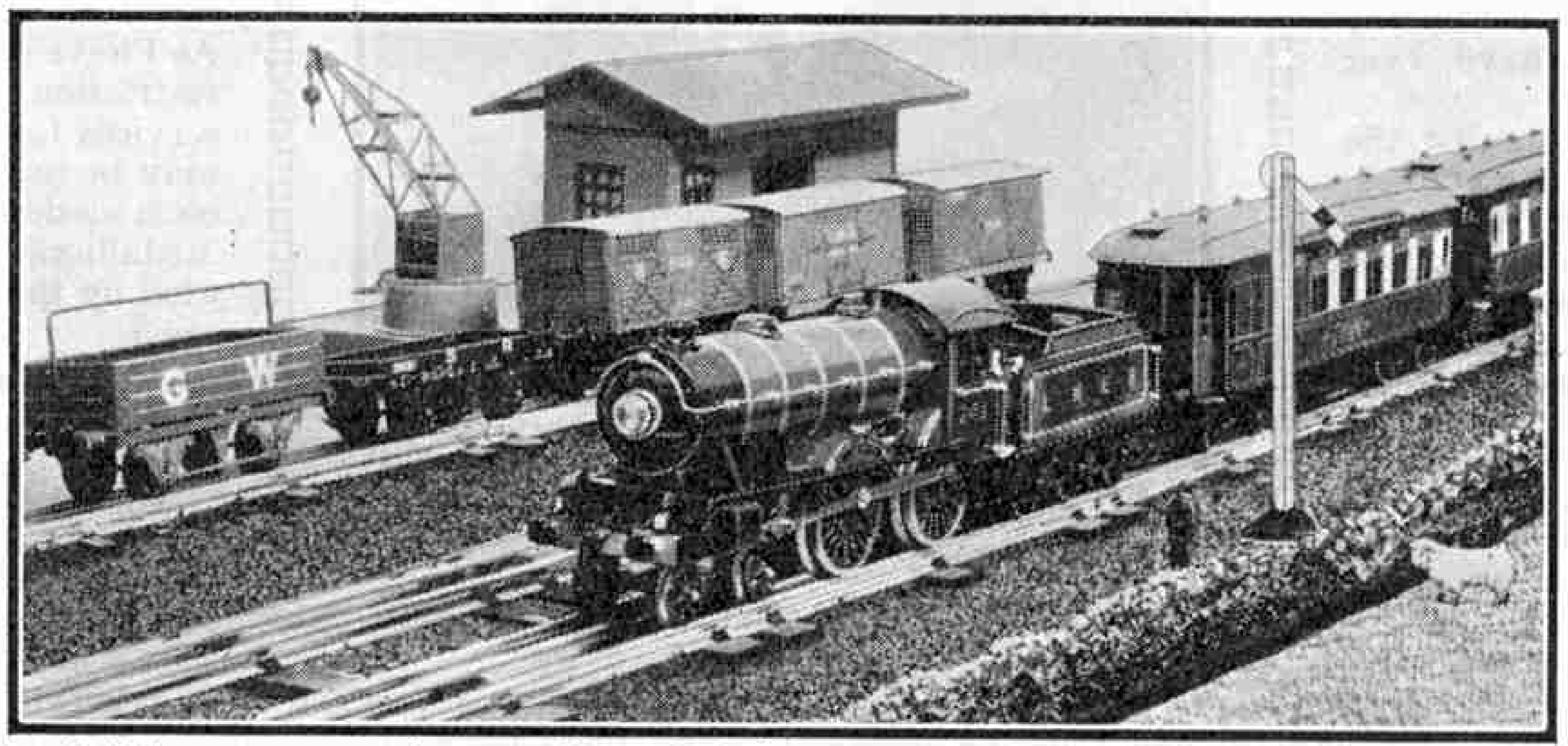
By this time most *"M.M."* readers will be thinking seriously about their Christmas presents. A large proportion of them will have decided already to take up the wonderful hobby of operating a Hornby model railway, and will be considering the best way of making a beginning. The object of this article is to explain clearly and simply the various possibilities, and to give really practical advice on making a wise choice.



A Hornby express hauled by a No. 2 Special Locomotive L.M.S.R. passing over a Level Crossing. Some very effective combinations of railway and road can be arranged in a similar manner to that shown in this photograph.

First of all there is the question of motive power, and here the choice lies between electricity and clockwork. Some boys, and many parents, are still under the impression that an electric railway is complicated and difficult to operate, and that it involves a certain amount of danger. This is entirely wrong. A Hornby electric railway is simple to install and run, and there is not the slightest risk of shock to the operator.

In homes where the electric mains supply is alternating current, the ideal Hornby Railway is one of the 20-volt type run from the mains through a Meccano Transformer. The Transformer reduces the high-voltage mains current to low-voltage current safe and suitable for the railway. There are no elaborate arrangements. The Transformer is simply connected to any convenient lighting socket, and the transformed current led to the track.



An all-Pullman express passing a wayside goods platform on an electrically operated layout. The locomotive is a No. E220 Special, L.N.E.R., and bears the name "The Bramham Moor."

As to the cost of running such a railway, this varies slightly, but generally speaking it may be said to be about as much as that of an ordinary household 60-watt lamp—about 15 hours for the cost of one unit.

It must be emphasised here that it is absolutely necessary that the mains supply should be alternating current. A transformer cannot be used with direct current. If there is the slightest doubt about the nature of the household current, the local electric supply authority should be consulted.

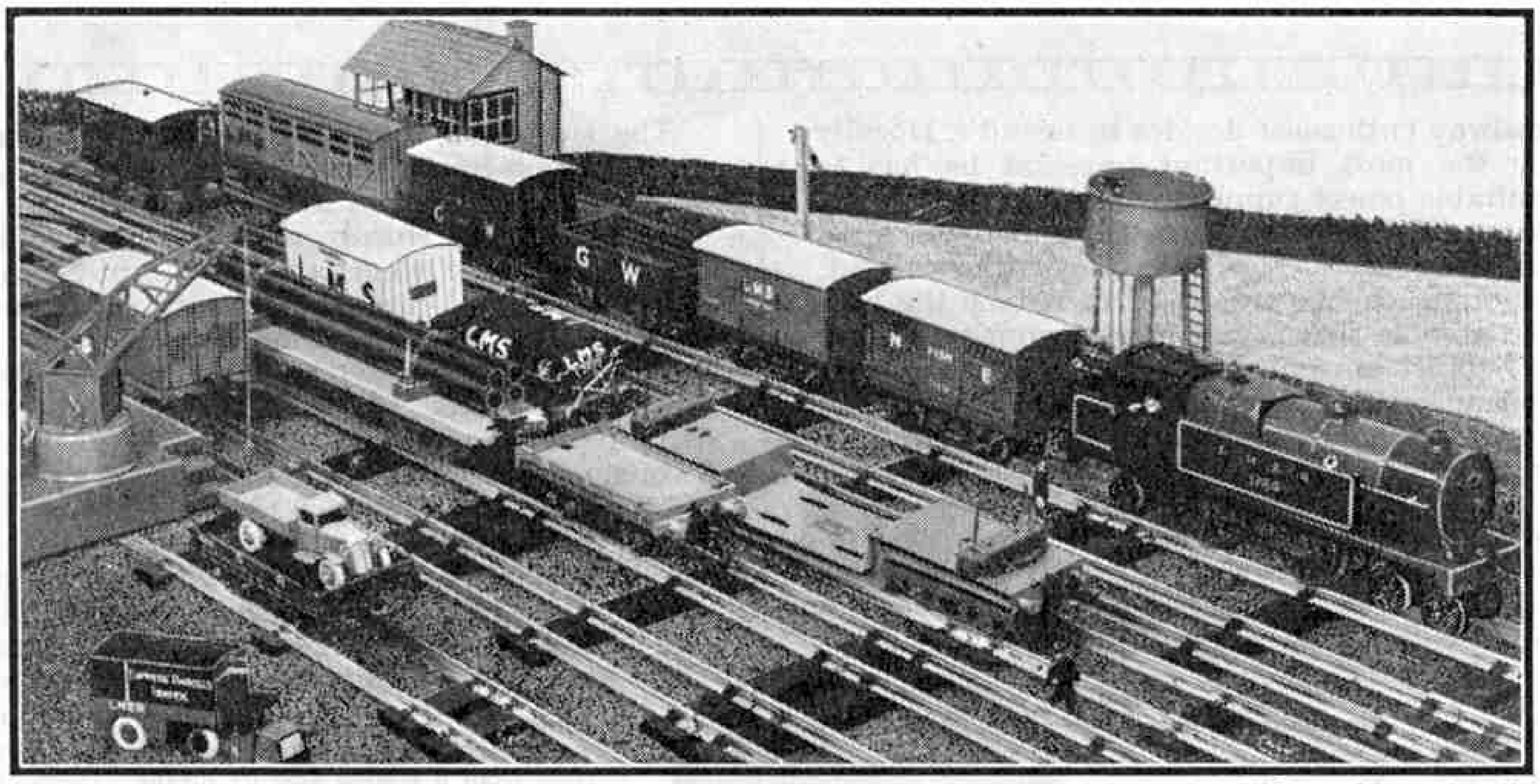
The outstanding advantage of the Hornby 20-volt system is that it provides all that is necessary for the development of a perfect miniature railway with everything under the operator's control. The magnificent 20-volt automatic reversing locomotives can be started, stopped, controlled for speed and reversed entirely from the side of the track, without any handling of cab levers. All the other locomotives in the system can be started, stopped and controlled from the lineside, and all except the very smallest are reversible by hand from the cab.

Wherever alternating current is available, the Hornby 20-volt railway system should be chosen without hesitation in preference to the Hornby 6-volt system. There are several reasons for this, the most important of which are that, on account of its higher voltage, the 20-volt system is electrically more efficient, and that the system includes the wonderful automatic reversing locomotives to which we have referred. These locomotives are not available in the 6-volt system.

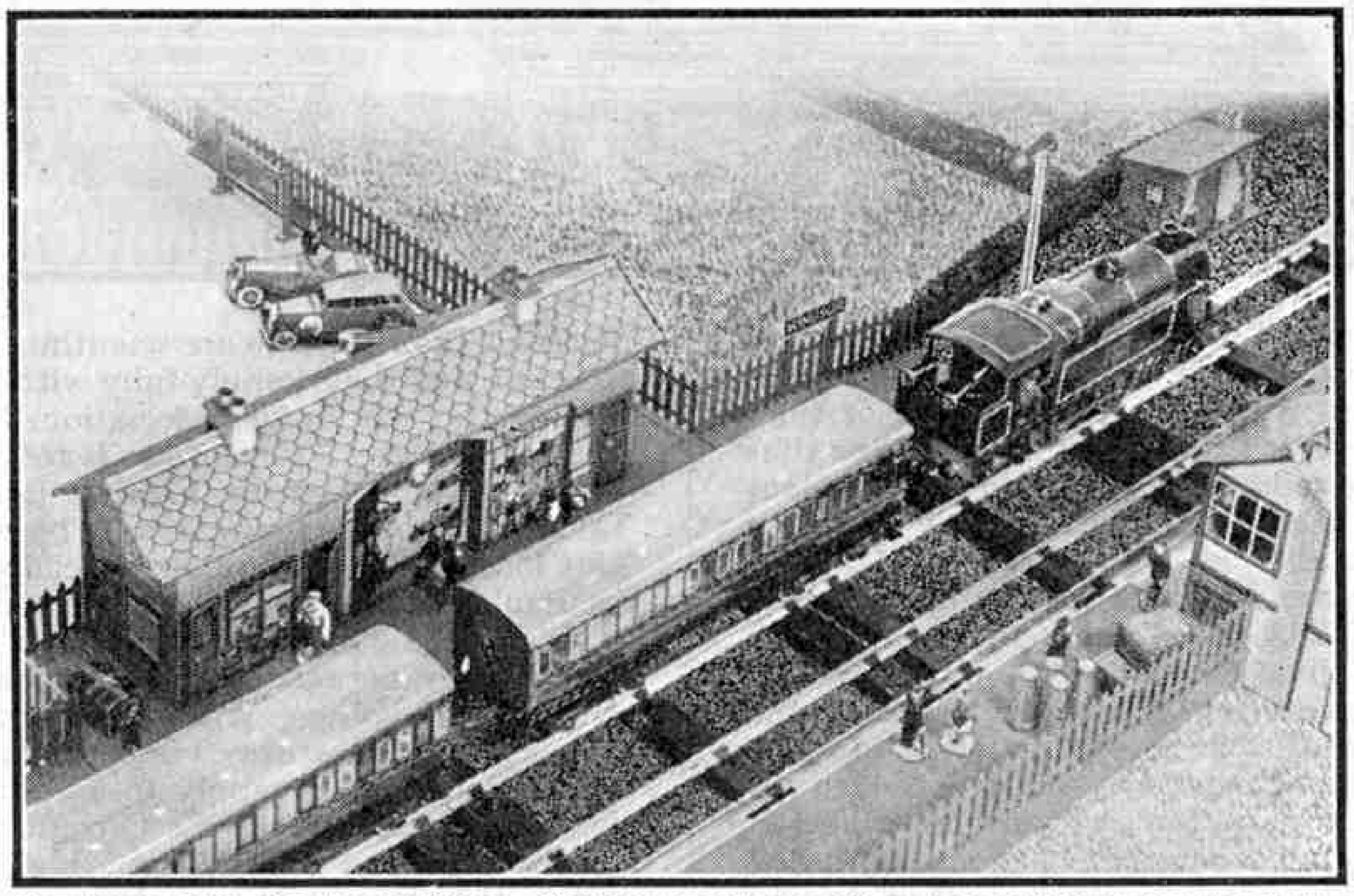
In many homes the mains supply is direct current, and in many others there is no mains supply at all; but this does not prevent the installation of a Hornby electric railway. Here the 6-volt system must be chosen, with a 6-volt accumulator as the source of power. A good quality accumulator with a capacity of 20 ampere hours should be employed, and this can be recharged as required by any electrician or garage for about one shilling.

Where alternating current is not available, many boys will prefer clockwork as the motive power. The Hornby clockwork system has been brought over a period of many years to a remarkable degree of perfection, and the locomotives are now the strongest, fastest and best pulling of their types in the world. Clockwork as motive power is specially suitable for railways on which it is intended to develop the fascinating pastime of time-table working.

When the question of motive power has been decided, the only important point that remains to be considered is whether the railway should be of 2 ft. or 1 ft. radius. If a reasonable amount of space is available, there should be no hesitation in choosing the 2 ft. radius track, for this makes it possible to use the whole of the locomotives and rolling stock in the Hornby system. On the other hand, 1 ft. radius track limits its possessor to the smaller locomotives and rolling stock, and in particular makes it impossible for him to use the 20-volt automatic reversing locomotives. In many cases, of course, space limitations will make it necessary to use the smaller radius track. In order to determine this point it should be borne in mind that a circle of 2 ft. radius track requires a space of 4 ft. 6 in. square, and a circle of 1 ft. radius track a space of 2 ft. 6 in. square.


A busy goods yard scene on a Hornby Railway. The variety of wagons shown gives some idea of the different kinds of traffic that can be dealt with.

After settling these various points satisfactorily we have to consider which group is to be represented by the miniature system. With a few exceptions Hornby Locomotives and Rolling Stock are available in the correct styles and colours of the four British railway groups. As a rule however there is no great difficulty in reaching a decision as most boys have a favourite group or section and they invariably attempt to reproduce the chief features of this, at least as regards the trains running on their own layouts. Sometimes the favourite group is that serving the district in which the individual owner resides. In such circumstances there are plenty of opportunities of observing practices that are suitable for reproduction in miniature.


An unusual view of a Hornby Station. The figures and accessories on the platforms, and the Dinky Toys Cars outside the Station, add considerably to the realistic effect.

Let us consider the variety of interests that present themselves to the owner of a Hornby Railway. Many boys devote their attention mainly to the chief passenger trains of real practice and their reproduction. A splendid selection of trains can be run in miniature with the correct rolling stock, and it is great fun to plan and operate a train service to meet the requirements of the centres that are supposed to be served by the line. The Hornby Pullman Coaches, which so closely follow their prototypes, can be assembled into complete trains that share all the characteristics of such well-known Pullman fliers as the famous *"Queen of Scots," "The Golden Arrow Limited"*—which has the reputation of being "the most fashionable train in Europe" — or the popular *"Bournemouth Belle."* There is a definite thrill in operating such trains in miniature, especially when one is familiar with the real thing and has watched its departure or arrival or, better still, has travelled on the particular train that is being reproduced.

Hornby Saloon Coaches, too, for the less specialised services, allow splendid standard main line trains to be made up. A feature of these Coaches—as also of the Pullmans just referred to—that emphasises the "long-distance" character of the trains they compose, is that they are provided with corridor connections so that a complete train can be vestibuled together in the correct manner. All boys appreciate the distinction that fittings of this kind give to a miniature train, especially when *"The Royal Scot"* or *"The Flying Scotsman"* is one of the regular trains on the system.

In addition to the chief expresses there is considerable interest in the make-up and operation of semi-fast or stopping trains. The numerous suburban and branch line trains all require the attention of the "General Manager" of the miniature railway, if the system is to be an accurate representation of the real thing. For all these trains the new No. 2 compartment-type Coaches are essentially suited.

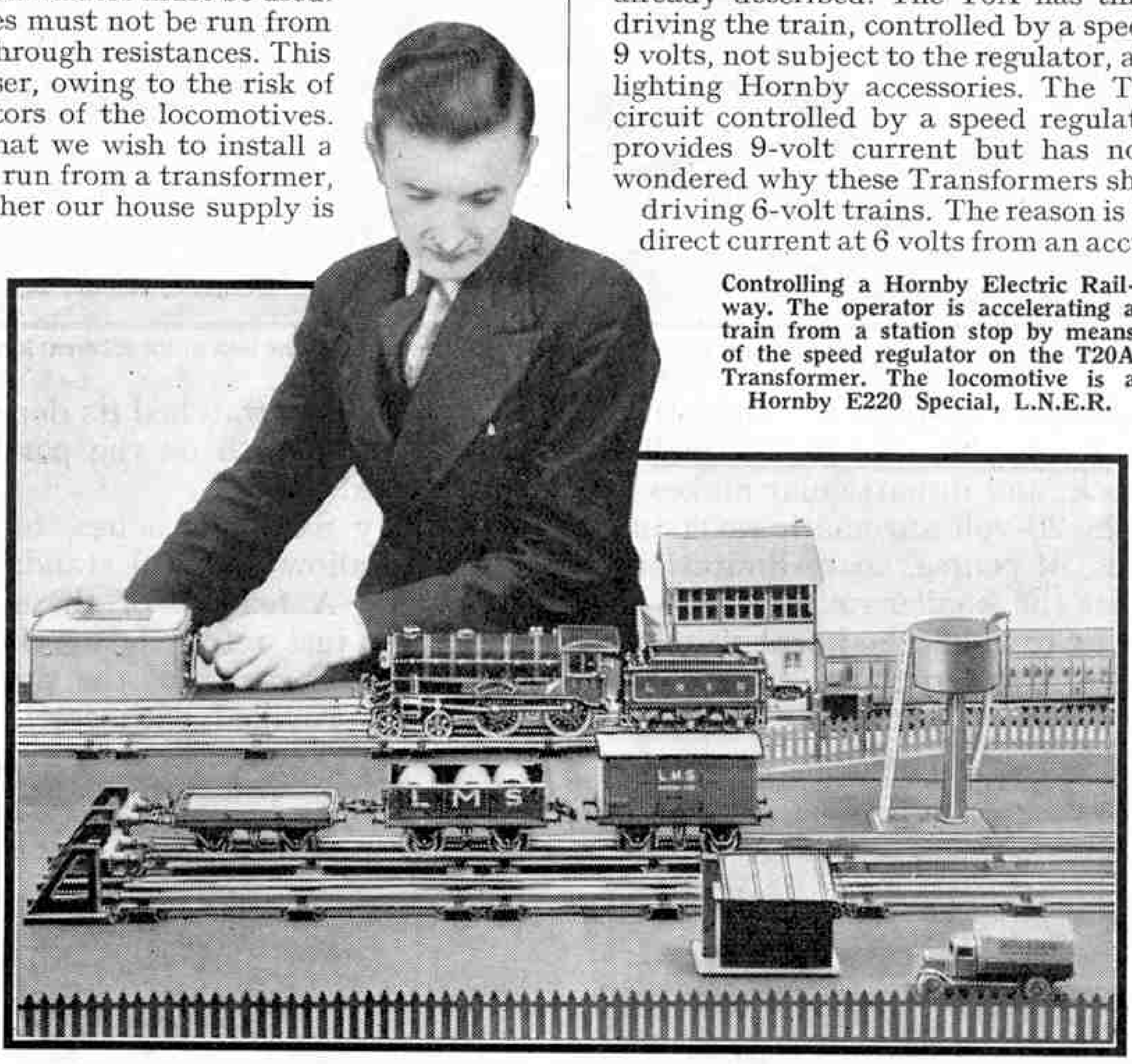
The goods side of miniature railway working is a particularly fascinating subject. The variety of wagons and vans that can be obtained is such that practically any kind of traffic can be dealt with. We can run coal and mineral trains, carry livestock and convey perishable foodstuffs. General merchandise, bulky freights such as machinery, oil, petrol and even dangerous gunpowder traffic, all have their appropriate wagons.

Power Supply for Hornby Electric Railways

Transformers to Run Two Trains

When a model railway enthusiast decides to install a Hornby Electric Railway the most important question he has to consider is that of a suitable power supply for the operation of his trains. Broadly speaking, the choice lies between mains operation and battery operation. If the mains supply is alternating current, then a Meccano Transformer can be employed to reduce the high voltage of the mains to a value that is safe and economical to use. If the mains supply is direct current, however, or if there is no mains supply at all, then an accumulator must be used.

Hornby Electric Locomotives must not be run from direct current mains supplies through resistances. This practice is dangerous to the user, owing to the risk of shock, and is bad for the motors of the locomotives.



Controlling a Hornby Electric Railway. The operator is accelerating a train from a station stop by means of the speed regulator on the T20A Transformer. The locomotive is a Hornby E220 Special, L.N.E.R.

Let us suppose first of all that we wish to install a Hornby Electric Railway to be run from a transformer, but that we are not sure whether our house supply is alternating current. The nature of the supply is always marked on the house electric meter, and an alternating current is denoted by the use of the sign ∿. The best plan, however, is to consult the local supply authority, who will not only state whether the current is alternating or not, but if it is will also state the voltage and frequency of the current, which details must be given when ordering a Meccano Transformer.

There are two Hornby electric train systems, one at 20 volts and the other at 6 volts. The 20-volt system is the standard one, and should be selected without any hesitation. It is not only more efficient from an electrical point of view, but also it includes the Hornby Electric Locomotives fitted with automatic reversing mechanism. All Hornby Electric Locomotives can be started, stopped and controlled for speed from the lineside, but these automatic reversing locomotives, which are of the finest of their kind in existence, can also be reversed from the lineside. They thus make possible the perfect electric railway, in which every movement of the train is controlled from the lineside without any necessity for handling the locomotives at all.

Three Meccano Transformers are available for the operation of 20-volt railways. Of these the T20A is definitely the best. It has three separate circuits. The first gives current at 20 volts under the control of a speed regulator for driving a train and lighting the locomotive headlight if one is fitted. The second circuit, also at 20 volts, is not controlled by the speed regulator, and is intended for running a Meccano 20-volt Motor, or for any purpose where a current of one ampere at 20 volts is required. It should be noted that these two circuits cannot be used together; that is to say either a train or a motor can be run, but not both at the same time. The third circuit, which can be used with either of the first two is at 3½ volts, and is intended specially for the illumination of the Hornby accessories that are fitted for electric lighting. This circuit will light up to fourteen 3½-volt lamps at the same time, so that stations, signals, signal cabins, level crossings, lamp standards, etc., can be illuminated with fascinating effect.

Next in importance is the T20 Transformer, which has one circuit at 20 volts controlled by a speed regulator similar to that of the T20A Transformer. The current from the T20 Transformer is intended for driving a train and lighting the locomotive headlight.

The third Transformer, the T20M, has one circuit at 20 volts, but has no speed regulator. In order to use it for train driving a Meccano 20-volt Resistance Controller must be included in the circuit.

The Hornby 6-volt electric railway system is designed specially for operation from accumulators. Any good-quality 6-volt accumulator with a capacity of 20 ampere hours will provide ample current for running one Hornby 6-volt train and illuminating the locomotive headlight if one is fitted. Hornby 6-volt trains can be operated also from alternating current mains supply through a transformer. Three Meccano Transformers are available for the purpose, and these resemble in type the three 20-volt Transformers already described. The T6A has three circuits, one at 9 volts for driving the train, controlled by a speed regulator; a second circuit at 9 volts, not subject to the regulator, and a third circuit at 3½ volts for lighting Hornby accessories. The T6 Transformer has one 9-volt circuit controlled by a speed regulator; and the T6M Transformer provides 9-volt current but has no speed regulator. It may be wondered why these Transformers should give current at 9 volts for driving 6-volt trains. The reason is that motors designed to run on direct current at 6 volts from an accumulator require an alternating current from a transformer at 9 volts to give their best performance.

All these Transformers are used in the same manner. The Transformer connection is plugged into any convenient light socket, and the transformed current is led to the track by means of either a TCP20 or TCP6 Terminal Connecting Plate, or an EMC6 or EMC20 Combined Switch Rail. An illustrated leaflet of instructions is supplied with each Transformer.

We are often asked whether the running of a Hornby Railway through a transformer involves any danger. The answer is that there is no risk at all, because the railway is not at any point in direct contact with the high-voltage mains current. All the Meccano Transformers are scientifically designed and perfectly constructed, and they comply fully with the requirements of the British Engineering Standards Association. To ensure absolute safety the insulation of every Transformer is tested at a pressure of 2,000 volts.

There is one Hornby Electric Locomotive, the EPM16 Special Tank Locomotive, that can only be run on direct current at 6 volts. This locomotive is therefore specially suitable for running from an accumulator. In many cases, however, it is desired to run this popular locomotive from the mains. This cannot be done through a Transformer, because although the current thus delivered is reduced to a suitable voltage, it is still alternating current. The problem is solved by the Hornby Transformer-Rectifier, which reduces the alternating current supply to a suitable voltage, and at the same time converts it to direct current. The Transformer-Rectifier is simply connected to the alternating current mains on the one hand, and on the other to the track by means of a TCP6 Terminal Connecting Plate. This instrument cannot be used for any other Hornby locomotive.

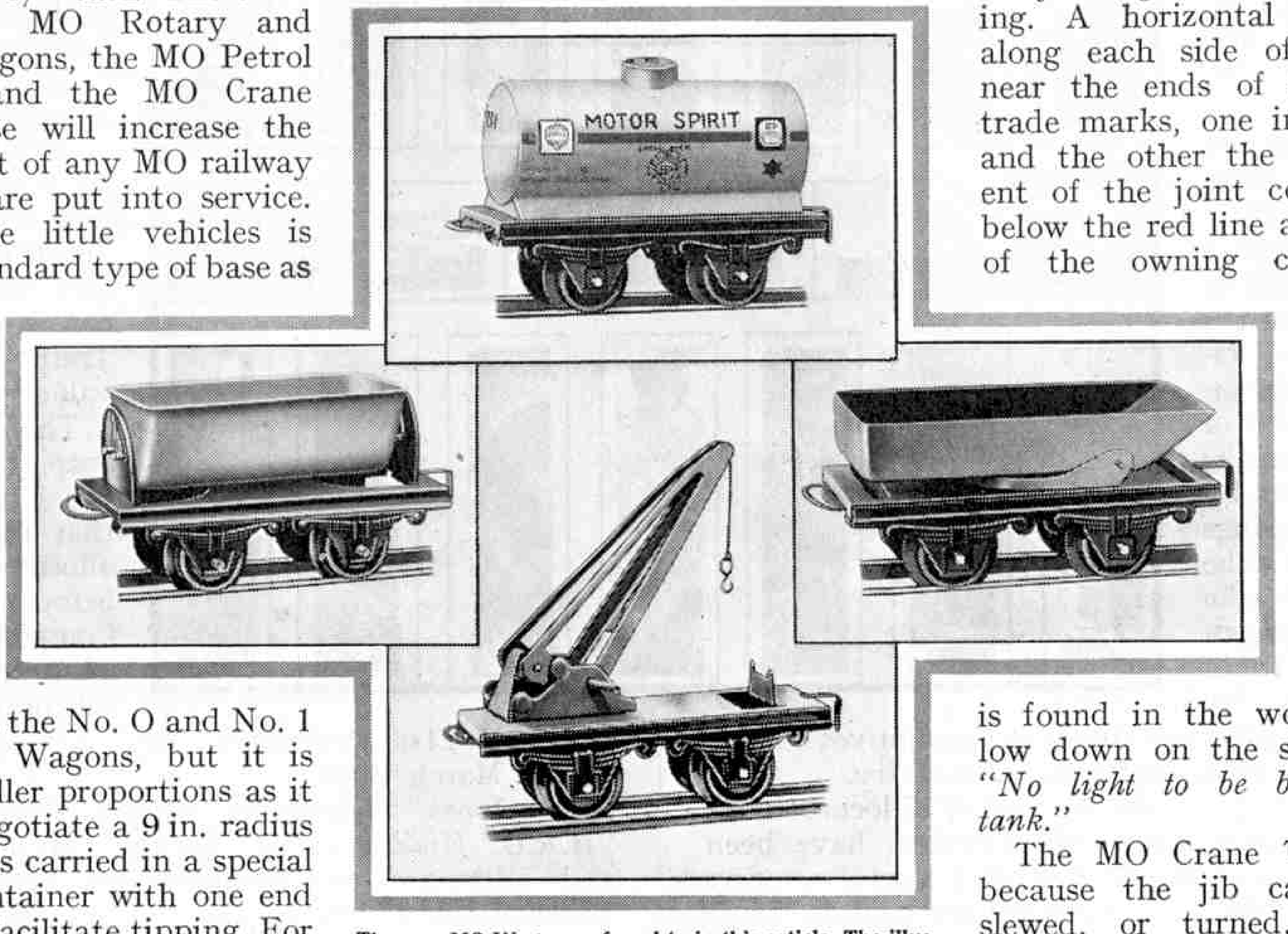
The Meccano Transformers already dealt with are designed to run only one train at a time. There have just been introduced, however, two Special Transformers, the T22M and the T26M, for 20-volt and 6-volt locomotives respectively, that have sufficient capacity to operate two trains at once. These trains may both be running on the same track, or may be on separate tracks. The Transformers do not include any control apparatus, and therefore a standard Meccano Resistance Controller, 20-volt or 6-volt as the case may be, must be used with them. When the two trains are running on the same track, one Resistance Controller is required; but if the trains are to be run on separate tracks two Resistance Controllers are necessary, one for each track.

New "M" Series Wagon Stock

By "Tommy Dodd"

THIS month I propose to deal with a subject of special interest to younger Hornby Railway enthusiasts, and to those who within the next few weeks will be commencing the miniature railway hobby with the simplest equipment available—that of the "M" Series. Train Sets of the "M" Series give many boys their introduction to our favourite hobby, and for some time both Coaches and Wagons have been available specially intended for use with the MO Locomotives. This season however some interesting additions have been made to the rolling stock, four new MO Wagons being now available at the uniform price of 1/– each. These are respectively the MO Rotary and Side Tipping Wagons, the MO Petrol Tank Wagon, and the MO Crane Truck. Their use will increase the realism and effect of any MO railway on which they are put into service.

Each of these little vehicles is mounted on a standard type of base as used for the older MO stock, the MO Pullman Coach and the MO Wagon. Taking first the Rotary Tipping Wagon, we find that this is a substantial and effective model. In its general style it resembles the No. O and No. 1 Rotary Tipping Wagons, but it is naturally of smaller proportions as it is designed to negotiate a 9 in. radius curve. The load is carried in a special scoop-shaped container with one end made sloping to facilitate tipping. For tipping the scoop is pivoted to a turntable unit, and this is mounted on what we may term the "floor" of the wagon. A double action is thus given to the scoop, for it can be turned completely round in a circle, and at the same time it can be tipped at any desired spot in its circular path. This Wagon is very useful when engineering work is being carried out on the line, and it is particularly suitable for ballasting operations.



The new MO Wagons referred to in this article. The illustration shows the realistic features of their design.

The Side Tipping Wagon, as its name implies, can only discharge its load at the side of the track, and is representative in design and style of the side tipping wagons that are used to such a large extent by contractors. The body of the vehicle is shaped like a trough and is supported at each end on two pins. These project horizontally, and when the body is in the normal upright position they rest in the bottom of slots made in the vertical end frames mounted on the base of the wagon. When the body is tipped to one side the pins on that side act as pivots, and the other two pins move up to the top of their slots and so prevent the body from tipping too far over. The relative functions of the pins are reversed in tipping to the other side.

The MO Petrol Tank Wagon is an interesting and attractive vehicle. The tank itself is similar in construction, although simpler, to that of the No. 1 Tank Wagons of the Hornby Series. It is of course mounted on a standard MO base. The finish of this little vehicle is excellent, being carried out, as far as the tank is concerned, by the tinprinting process. It is based on the latest style adopted for the tank wagons operated by the "Shell-Mex and B.P." organisation, the tank body being cream with black lettering. A horizontal red band runs along each side of the tank, and near the ends of this appear two trade marks, one indicating "Shell" and the other the "B.P." constituent of the joint concern. Centrally below the red line appears the name of the owning company and a combined trade mark, and the number of the wagon is shown at each end of the tank. A reminder of the dangerous nature of the cargo carried by such wagons is found in the words that appear low down on the side of the tank: *"No light to be brought near this tank."*

The MO Crane Truck is notable because the jib can not only be slewed, or turned, round on its base, but also can be lowered from its normal working position to rest horizontally on a special support while travelling. It is retained in the working position by a special clip arrangement attached to the base. Release of this permits the lowering of the jib. There is a cranked winding handle from which the "rope," of suitable cord, is led over a dummy pulley in the end of the jib and ends in the usual hook.

These new Wagons increase the variety of traffic that can be handled on the line. Many boys no doubt will be keen to find suitable loads for the two Tipping Wagons. Dried peas are perhaps the most satisfactory substance, for they cause no mess—an important matter on MO railways laid out on the table! Nor are they heavy, so that their use will not have an adverse effect on the haulage power of the MO Locomotives. Dried peas therefore are superior to coal or similar substances that need special treatment to render them suitable for use, and even then their weight is an objection. Although the Tank Wagon and Crane Truck require no loads they are most effective vehicles.

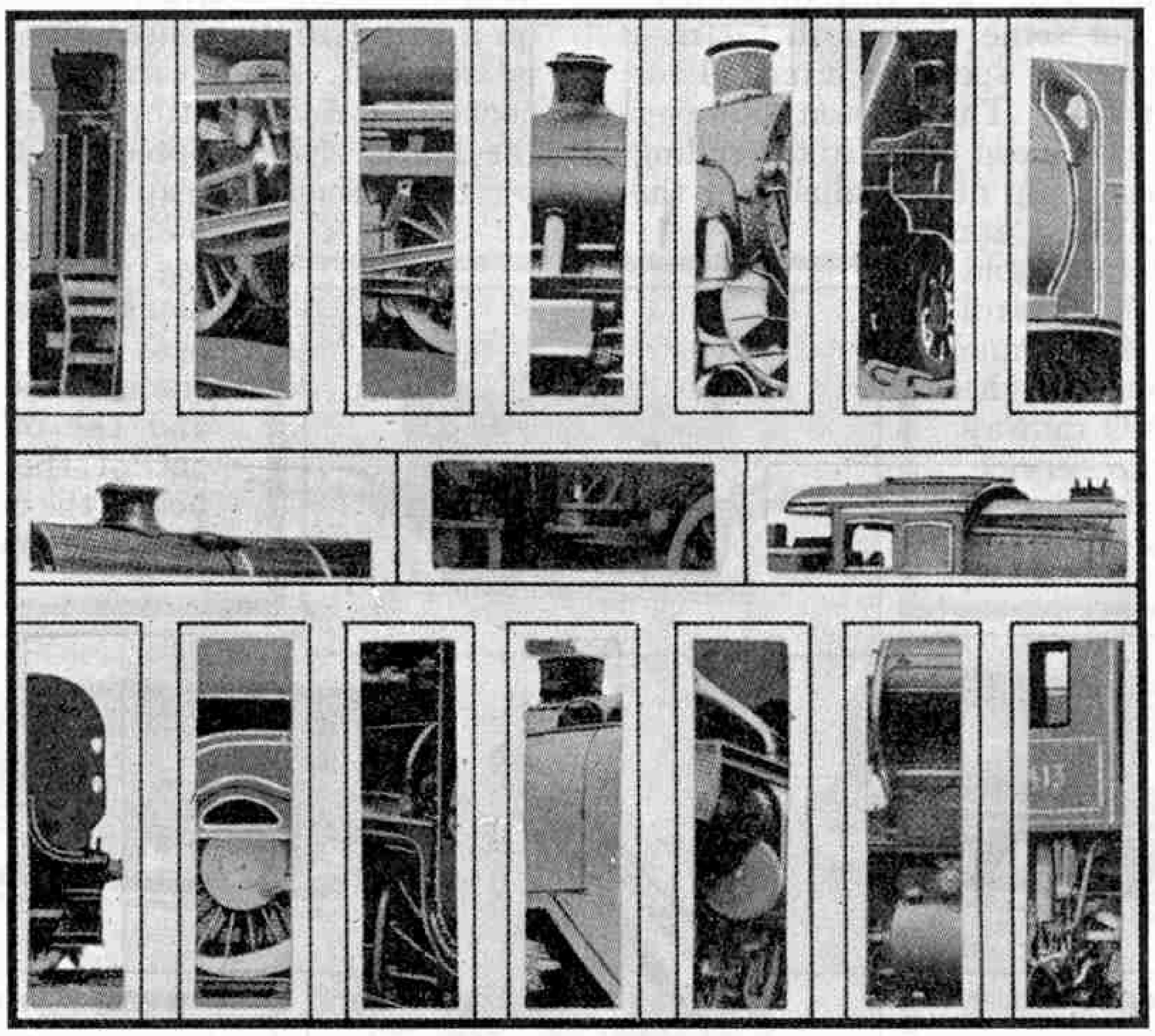
Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. Christmas Competitions

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

HIDDEN LOCOMOTIVES CONTEST

The locomotives of the British railway groups are on the whole quite distinctive individually. In spite of the generally similar trend of modern design in certain respects, no one could confuse an L.M.S.R. 4–6–2 of the *"Princess Royal"* class with an L.N.E.R. "Pacific." There are however certain classes that to the casual observer appear to be identical, but which, to enthusiasts such as H.R.C. members, show distinctive features of design. Thus the L.N.E.R. "Pacifics" and "Super-Pacifics" are almost identical in external appearance; but the "Super-Pacifics" can be distinguished by the presence of the reversing rod on the left-hand side, and by two small raised casings that appear on the upper surface of the smoke-box. Foreign practice has at times been influenced by British design, so that some Overseas locomotives exhibit features similar to those found in this country.



Illustrated on this page are portions of 17 locomotives. The locomotives from which the portions have been taken are not easy to identify, but after careful scrutiny it will be found that the illustrations contain some characteristic feature by which the identity of the class reveals itself. In this contest competitors are required to make a list of the locomotives reading from left to right, giving their class, wheel arrangement and owning company. The sender's name and full address must appear at the end of the list, together with his H.R.C. membership number.

The First, Second and Third Prizes will be cash to the value of £2-2s.-0d., £1-1s.-0d. and 15/– respectively. Six Consolation Prizes also will be awarded, consisting of Hornby Train goods to the value of 10/– each.

The Home closing date is earlier than usual this month, so that the prizes can be allocated for despatch before Christmas Day. Competitors are asked to make a careful note of the date, which is 21st December. The Overseas closing date is 31st March, 1936.

Envelopes containing entries must be marked *"H.R.C. Hidden Locos"* in the top left-hand corner and addressed to Headquarters at Meccano Ltd., Binns Road, Liverpool 13.

"My Favourite Locomotive"

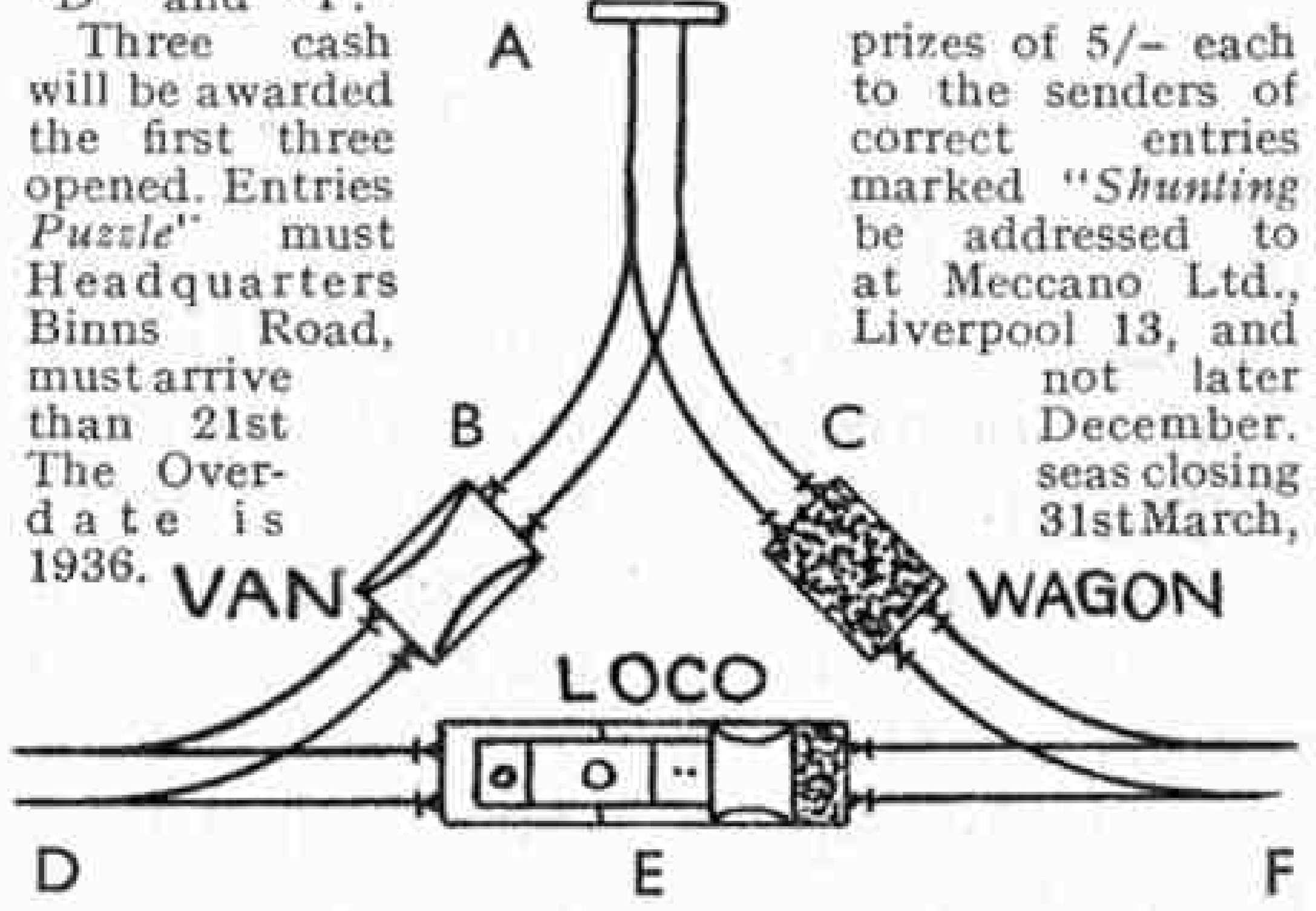
To most railway enthusiasts there is usually one locomotive or class of locomotive that is held in special esteem. The merit of such favourites is not necessarily their power or appearance, but sometimes results from personal association and familiarity with their work. We present therefore *"My Favourite Locomotive"* as the subject of this Drawing Contest.

To the four competitors in each Section, Home and Overseas, who submit the best drawings, prizes consisting of any products manufactured by Meccano Ltd. to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. On the back of each entry must be clearly written the competitor's name, age, full address and H.R.C. membership number. Unsuccessful entries will be returned if they are accompanied by a stamped addressed envelope of suitable size.

Entries should be marked *"H.R.C. Drawing Contest"* and posted to reach Meccano Ltd., Binns Road, Liverpool 13, before 21st December. Overseas closing date 31st March, 1936.

Shunting Puzzle

The locomotive at "E" is required to shunt the van standing on the branch "B" to branch "C" and the wagon standing on the branch "C" to branch "B," and then to return to its original position. The short spur "A" is terminated by buffer stops and can accommodate one vehicle only at a time, but not the locomotive. The main line extends indefinitely beyond the points "D" and "F."



Three cash prizes of 5/– each will be awarded to the senders of the first three correct entries opened. Entries marked *"Shunting Puzzle"* must be addressed to Headquarters at Meccano Ltd., Binns Road, Liverpool 13, and must arrive not later than 21st December. The Overseas closing date is 31st March, 1936.

COMPETITION RESULTS

HOME

September "Errors Contest."—First: K. Costain (5108), Bolton. Second: B. S. Jones (18596), Duffield. Third: J. N. Leedam (43458), Burnley. Fourth: R. O. Lyon (39292), Bristol, 6. Consolation Prizes: G. R. Sloman (34053), Rock Ferry; B. Gerrard (22476), Thornton Heath; R. Sutton (34561), Wolverhampton; H. J. Joslin (30713), Southall; R. B. Shaw (40961), Liverpool 19; D. L. Nicholson (14511), Bournemouth.

September "Railway Photo Contest."—First: D. F. Forbes (14092), Leith. Second: J. L. Stevenson (22346), Edinburgh 11. Third: D. Kelk (28578), Staplehurst. Fourth: E. C. Morgan (10735), Wandsworth Common. Consolation Prizes: V. Le Maistre (30067), Broughty Ferry; F. Hodson (9430), Bolton; P. Andrew (22670), New Barnet; D. J. W. Brough (8246), Cheam; D. Erskine (41002), Manchester; V. L. Breeze (2134), Lewes.

OVERSEAS

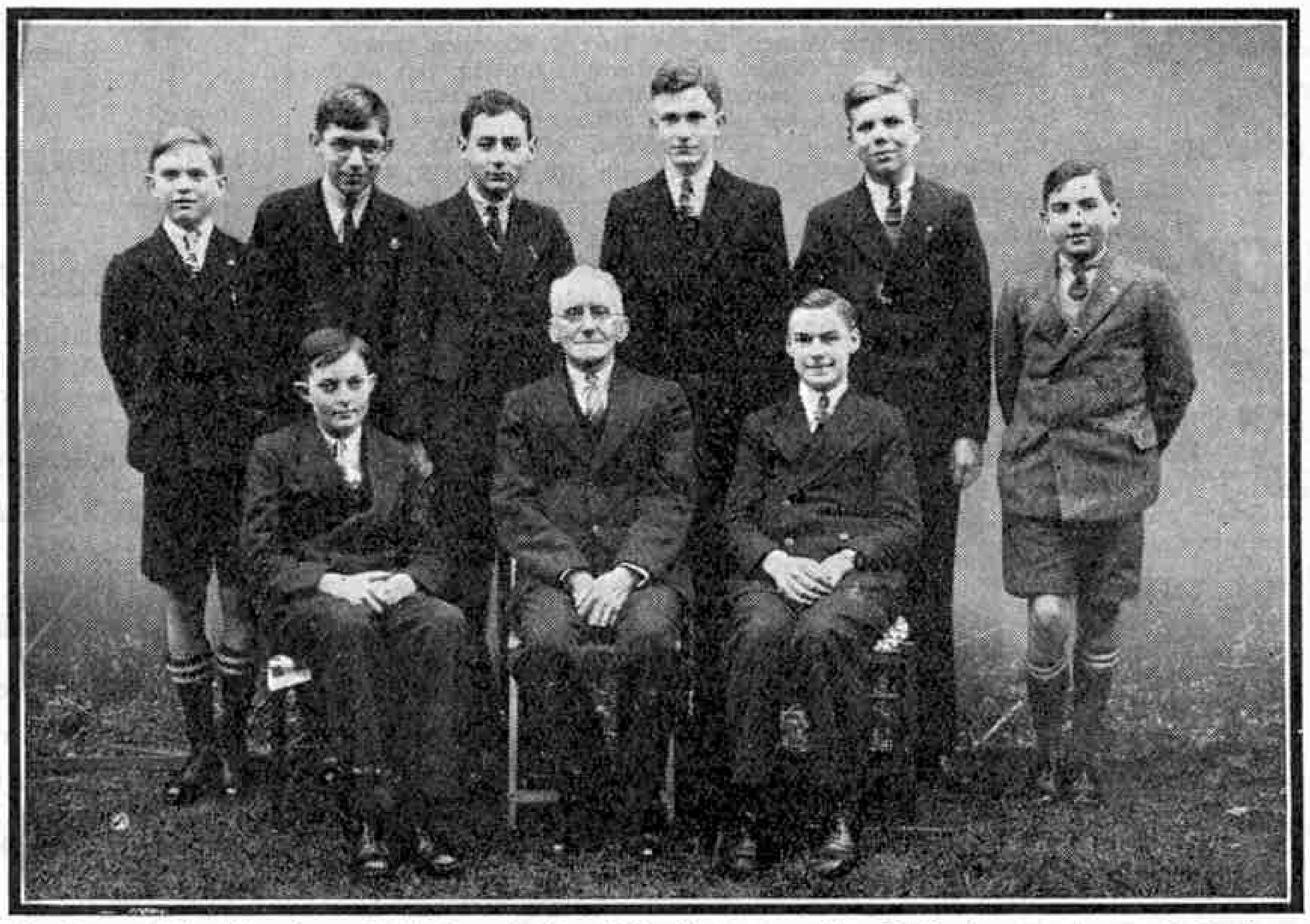
June "Word-Building Contest."—First: J. A. Gnanadurai (33344), India. Second: H. C. Key (24764), India. Third: E. A. Bunt (24651), Capetown. Fourth: V. M. Daines (29629), S. Africa. Consolation Prizes: L. F. Haughton (7783), S. Africa; R. Myburgh (37538), Capetown; D. Hodgson, New Zealand; M. C. Lupton (43423), S. Africa; D. Murison (37642), Buenos Aires.

June "Railway Photo Contest."—First: R. B. McMillan (9592), Australia. Second: I. McIntyre (31781), Winnipeg. Third: J. Hancock (38964), S. Africa. Fourth: C. R. Sanders (29648), Argentine.

Branch News

Chorlton - cum - Hardy.—Various improvements in the Branch layout have been made recently. Additional points have been provided in order to secure improved running and the Branch Room has been decorated with suitable railway posters. Members have constructed a miniature mail train, complete with automatic pick-up and discharge apparatus. The Branch layout represents the L.N.E.R. and through services have been arranged from the "Southern Railway" by the addition of rolling stock painted in this company's colours. Secretary: G. H. Gill, 56, Highfield Road, Chorlton-cum-Hardy.

Elmside (Exeter).—Relaying of the track has been successfully completed and the new layout includes three stations. As a result improved services have become possible, and various trains for different destinations according to the new schedules have been introduced. A special "Branch Anniversary" programme was carried out with a greatly augmented service of trains. A visit has been paid to Sidmouth Meccano Club and to the neighbouring St. Thomas H.R.C. Branch. A visit has also been received from the latter Branch, and such visits are now to form part of the regular programmes of both Branches. Secretary: T. Smith, 98, Ladysmith Road, Exeter.



Members of the Streatham Park Branch, No. 232. Chairman: Mr. P. Doyle; secretary: J. B. Cass. This Branch was incorporated in August 1932, and possesses an extensive track on which trains are operated to timetable. Automatic colour-light signals are used throughout. Photograph by H. Litchener, London, W.1.

Wimborne Grammar School.—With the changing of Branch officials some re-organisation has been carried out, and great enthusiasm is being shown, particularly by the Junior members. Track meetings have been successful on the whole, although traffic operation has suffered from several mishaps. It is hoped to eliminate such troubles with further practice on the part of new members, and with a more strict adherence to the rules. A new lighting system is being installed and this will greatly improve the effectiveness of the layout. Secretary: E. S. How, Wimborne Grammar School, Wimborne, Dorset.

Islington.—Various talks have been given to members, chiefly on subjects of railway interest. Experiments are being made with different rail formations with a view to discovering the most suitable layout for Branch purposes. The next development will be the installation of a signalling system. It is anticipated also that timetable running will be introduced in due course. A visit has been paid to Paddington station and notes were made of items of interest observed there. With a view to increasing the membership of the Branch a feature has been made of cinematograph programmes and on these occasions each member is encouraged to bring a friend along with him. Secretary: E. Muxlow, 7, Regents Park Road, London, N.W.1.

AUSTRALIA

Parramatta.—Regular meetings have been held and a great deal of experimental work has been carried out on the Branch layout to determine the most useful arrangement of loop lines and sidings. Up to the present clockwork locomotives have been used exclusively, but it has now been decided to carry out the electrification of the track. Hornby 20-volt Locomotives are being obtained and a great deal of the older rolling stock is being replaced with new and modern equipment. It is intended to divide the track into separate electrical sections to allow more realistic and complex working to be carried out. Secretary: H. H. Matthews, 27, Ross Street, Parramatta, N.S.W., Australia.

AN ATTRACTIVE EXHIBITION

An attractive Exhibition organised by the Bowerham (Lancaster) Branch of the Hornby Railway Company will be held on 19th and 20th of this month at 23, Chester Place, Bowerham, Lancaster. It will be open from 6.30 p.m. to 10.30 p.m., and the charge for admission will be: Adults 2d.; Children under 16, 1d.

Sydney.—Outdoor activities have continued to be popular, particularly railway excursions to various points of interest in and around Sydney. Photographic competitions involving subjects in connection with these excursions have aroused keen interest. Recent additions to Branch equipment include a 4–4–0 steam locomotive, kindly presented by the Chairman. This will be used for long-distance express passenger traffic. Membership continues to increase and it is hoped shortly to remove into a larger Branch Room. Secretary: A. R. Wade, Box 1749 J.J. G.P.O., Sydney, Australia.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below. All owners of Hornby Trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who apply.

Dublin—S. J. Carse, 38, Oakley Road, Ranelagh.
Glasgow—Mr. J. B. Haddy, 15, Naseby Avenue, Glasgow, W.1.
Goodmayes—A. S. Beard, 57, Ashgrove Road.
Nottingham—C. T. Eley, 129, Harrington Drive, Lenton Sands.
Poole—V. Pearcy, "Braemar," 151, Longfleet Road.
Silverdale—G. F. Wilkinson, Hatchstead.
Southport—D. B. Moss, 141, Forest Road.

Branches Recently Incorporated

291. Paignton—H. W. Anderson, 22, Laura Grove, Paignton.
292. Patricroft—A. Howarth, 42, Nelson Street, Patricroft.
293. Chippenham—K. Roberts, 113, Malmesbury Road, Chippenham.

SETS (POSTAGE EXTRA)

5 Gold Coast	... 3d.	20 Austria	... 2d.
10 ,, ,,	... 6d.	20 Belgium	... 2d.
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20 ,, ,,	... 1/2	20 Dantzig	... 4d.
5 Nigeria	... 3d.	10 Egypt...	... 2d.
8 ,,	... 6d.	20 France	... 2d.
5 North Borneo	4d.	20 French Cols.	... 3d.
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J. RUSSELL
23, Shanklin Drive, Westcliff-on-Sea

NYASSA TRIANGLES!
EGYPT AIR MAILS ! !
PICTORIALS ! ! !
124 STAMPS 6d.

Including set of unused **Nyassa Triangles.** Set of **Egypt 1933 Air Mails** showing aeroplane flying over Pyramids. **15 Canada** including **Jubilee** and **Ottawa Conference** issues. Interesting **Brazil 1933 Airport Fund** stamp. **Roumania 1931 Aviation** stamps showing monoplane. Other stamps include unused air mails, surcharged issues and pictorials. All different. **Price 6d. (Postage 1½d. extra.)** Money and all postage will be returned if not satisfactory. We have numerous other offers at low prices. Hundreds of unsolicited testimonials have been received.

W. BENNETT
53, Marlborough Road, LONDON, E.8

THE WARRIOR & SHIP PACKET FREE!!

All kinds of warriors are represented in this packet, from the modern soldier equipped with steel helmets and rifles down to the native fighter with the most primitive types of arms. The ships range from glorious private yachts to junks and native sampans. To mention a few of the fine stamps, we notice an ex-German Colony, depicting the beautiful yacht of the German Emperor, Argentine (San Jose in uniform), **JUGO-SLAVIA** (nude slave breaking chains), Hungary (the beautiful Parliament issue), scarce **UKRAINE,** Cochin State, China (native craft), beautiful Guiana, large **KING ALBERT** stamp, also many surcharged issues, Italy, **FASCISTI,** and **KENYA.** You must take immediate advantage of this extraordinary offer, which will not possibly be repeated, as we cannot buy some of the stamps. There are nearly 60 all different, and they will make a beautiful show in your album. Finally we are including a beautiful Turkey depicting soldier going to war. **ALL FREE.** Write now requesting approvals, and enclose 2d. for postage.

LISBURN & TOWNSEND (M.M.), LIVERPOOL 3.
(Ask for 1936 Price List of Stamp Albums, etc.)

UGANDA PACKET—FREE!!

This splendid packet contains the **New Uganda** illustrated (Dhow on Lake Victoria), **New Belgium** (Train drawn by Diesel engine), **New Roumania** (portrait of King Carol), Siam Airmail (Garuda bird), **1935 New Zealand pictorial,** Gold Coast and Australia pictorials and **10 different Canada including the new issue of 1935. All these new stamps free** to genuine applicants for our Approval Sheets, who enclose 2d. for postage.

SHIRLEY STAMP CO.
19, Sandringham Avenue, London, S.W.20

30 TREE STAMPS and STAMP MOUNTS for all applicants for my approvals.—Dermot Cadogan, 61, South Main Street, Wexford, Ireland.

FREE!! "LOCO" SET AND ENGINEERING PKT.

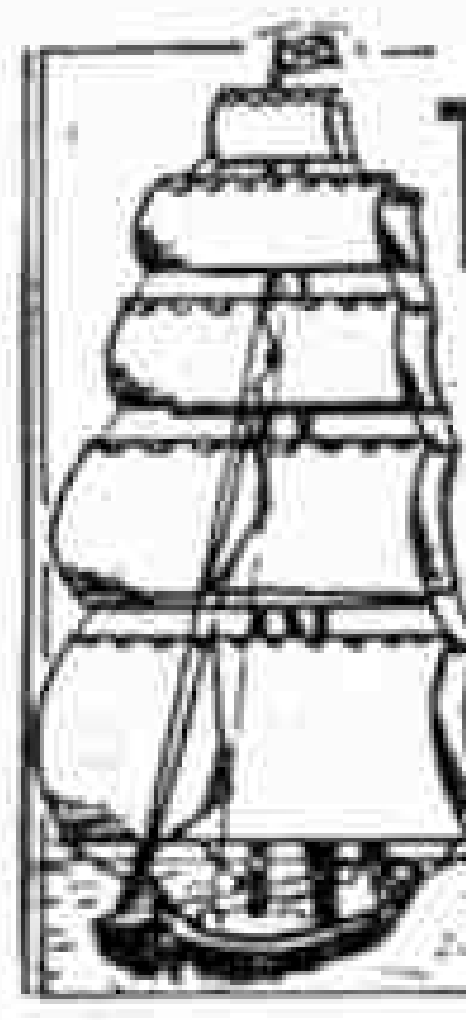
Many different stamps, showing Aeroplanes, Engines, Pyramids, Palaces, Ruins, Castles, Ships, Steamers, Windjammers, Junks, Statues, Schools, Mosques and Churches from Brazil, Egypt, **Turkey, Morocco, Greece,** China, **U.S.A.** (Statue of Liberty), **Algeria,** Set of **3 Charkhari, Martinique, Caledonia, Niger, Tunis,** etc. **ALSO** a fine packet of **50 all different stamps.** Enclose 2d. postage, **REQUESTING APPROVALS.**
SHOWELL BROS., 42, Vanbrugh Hill, LONDON, S.E.3.

STAMP APPROVAL SHEETS at special discounts; state special interests.—Apply—J. Nixon, "Stamps," 3, Ravenstone Drive, Giffnock, Renfrewshire.

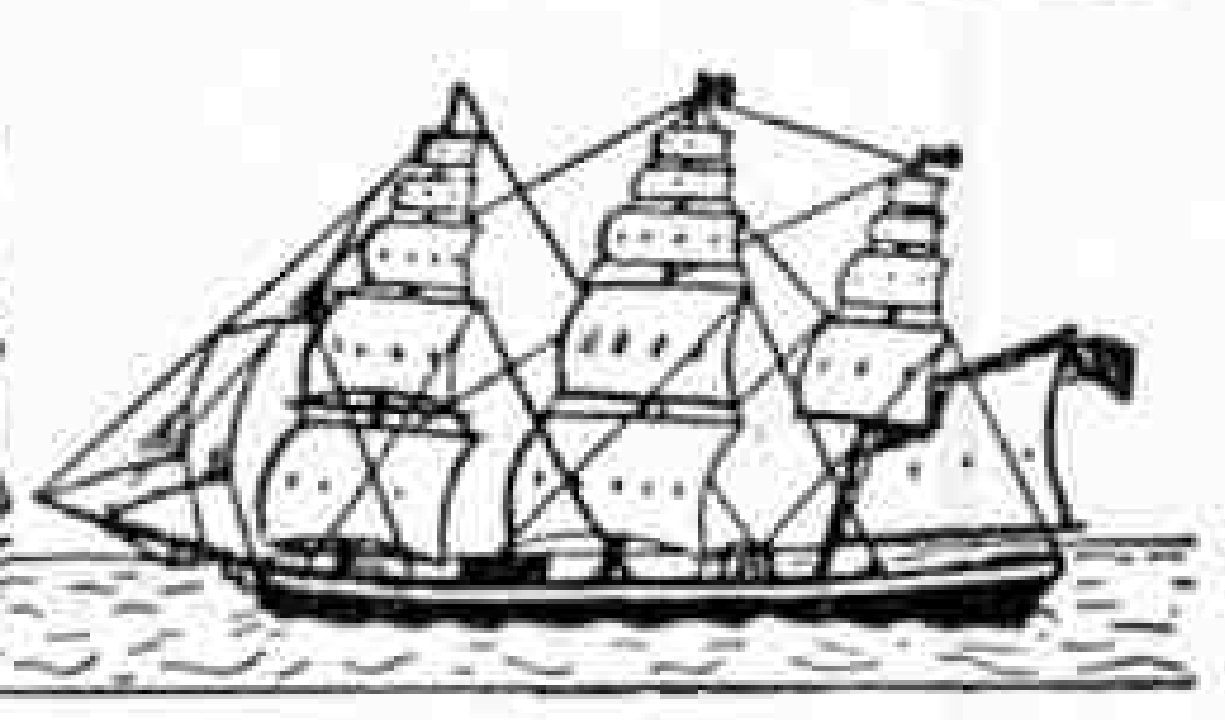
CHEAP APPROVALS

My beautiful Approval Selections are ideal for filling those vacant spaces. Pictorials, Colonials, and hard to get items. Selections from 4 a 1d. Free Gift Bi-coloured Persia all applicants.

A. V. TAPP,
108, CHESTERFIELD RD., BRISTOL



THE 'SHIP' PACKET



This marvellous packet is offered under cost as an advertisement, **45 different stamps each with a ship on it.** A regular armada. **GABOON,** a rare **FOOCHOW** (War Canoe), wonderful flotilla of caravels from **DENMARK** (complete set), **ITALY** (Naval Academy), **NEW CALEDONIA, IVORY COAST, COSTA RICA,** a fleet of **7 CHINESE** junks usually sold at 10d., **TRINIDAD & TOBAGO, MAURITIUS, SOUTH WEST AFRICA, NEWFOUNDLAND, U.S.A., B. GUIANA,** set of **S. AFRICA, GREECE, POLAND, INDO-CHINA,** etc. Price **4½d.,** postage 1½d. (abroad 3d. extra). Purchasers of this packet asking for approvals receive **FREE** set of **4 SPAIN** (Columbus, each with his ship on it). Senders of addresses of stamp collectors receive **FREE** set of **6 VENEZUELA** or **6 PERSIA, 100 BRITISH COLONIALS 1/–, 20 AIRPORT 6d., 6 TRIANGULARS 6d. VOLUMES OF B.O.P. CHEAP.**

H. C. WATKINS (M. Dept.), Granville Road, BARNET

THE FIRST STAMP Ever Issued

(British 1840 Penny Black) for P.O. 2/–! It is guaranteed genuine in every respect. Its companion stamp (1840, 2d. blue) for a further 5/– (cat. 15/–)! Other "Classics" which every Collector should have are the **Cape of Good Hope Triangulars;** we offer 1d. rose (cat. 40/–) for 12/6; 4d. blue (cat. 15/–) for 5/–; and 6d. pale lilac (cat. 40/–) at 12/6. Superb approvals of any country against approved English References or a deposit. **Full Lists Free.**

NORRIS & CO. (Dept. M), NORWOOD, LONDON, S.E.19

FREE. 50 All Different BELGIUM

I will send the above fine collection, **including** the **scarce "Tin Hat" Stamp, absolutely free;** to all Stamp Collectors sending 2d. postage (abroad 4d.). Only one gift to each applicant.

G. P. KEEF, WILLINGDON, EASTBOURNE

ALL BRITISH COLONIAL APPROVALS

Fine **BRITISH COLONIAL PICTORIAL SETS OF CAYMAN ISLANDS & GAMBIA FREE** to all Collectors sending 1½d. stamp and requesting **ALL BRITISH COLONIAL APPROVALS, BRITISH COLONIALS ONLY** on approval at bargain prices, including Jubilee issues, West Indians, East and West Africa, Cyprus, Gibraltar, Iraq, Papua, Samoa, and many other fine Colonials. (No stamps sent abroad.) **C. H. SHAW (Dept. M12), 95, CHRISTCHURCH AVENUE, KENTON, HARROW.**

A FLOWN "AIR MAIL" COVER FREE to Customers asking for Approvals and enclosing postage. English 1d. blacks from 2/– each; 100 Colonials 9d.; 50 Australasia 1/–; 50 American 1/–; 50 S. African 1/–; 50 West African 2/6; 50 British 2/6; 50 Greece 2/6; 50 Indian and Native States 1/3; 3 Falklands 4d.; 20 Mexico 9d.; 20 Brazil 9d.; 3 Antigua 4d.; 25 Egypt 1/–; 12 Malta 1/–; 12 Capes 1/–; 50 Italy 1/–; 12 Barbados 1/–; 12 Gold Coast 1/–; 6 Fiji 9d.; 20 Java 6d.; 8 Sarawak 1/–; 9 Sierra Leone 1/–; 15 Rhodesia 1/–; 12 Nigeria 1/–; 12 Kenya 9d.; 30 Old Spanish Colonies 1/6.
A. E. Witherick (Est. 1880), 12, Meriden St., Coventry.

LOOK BOYS! 50 diff. Brit. cols. free! Ask appros. (post 2d.).—Tom Brown, 11, Carden Place, Aberdeen.

100 DIFFERENT STAMPS FREE to applicants for ½d. Approvals.—Cox, 21, Dennis Mansions, Westcliff.

Free and Post Free! Bumper packet including Jubilee. Request approvals.—G. Kingsmill, New Barnet, Herts.

COLONIES PACKET FREE!!

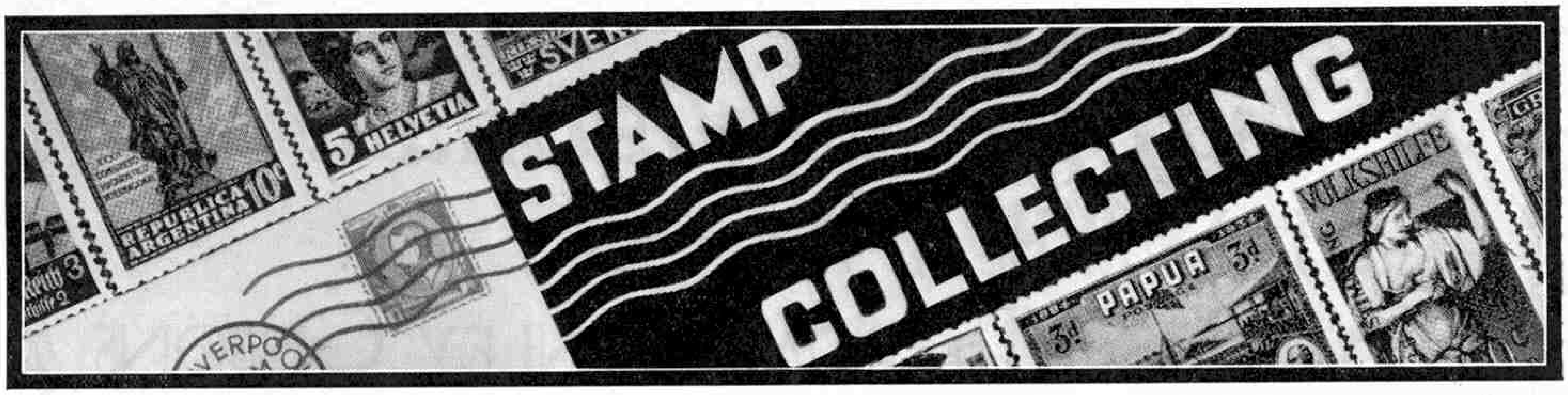
Containing a splendid collection of stamps from the colonies—British, French, Belgian, Portuguese and Spanish. Included are **NAURU** (as illustrated), India, **TURKS** and **CAICOS** (melocactus communis), Australia (kangaroo), **CYPRUS,** Cameroons, **MOYEN-CONGO** (train on viaduct), **OUBANGUI-CHARI** (panther in ambush), **BELGIAN CONGO,** Spanish Morocco (pictorial), **ANGOLA** (ceres) and a **SILVER JUBILEE** British Colonial. **FREE** only to genuine approval applicants sending 2d. postage (abroad 1/–).

HELY. HUTCHINSON (M.4), Hurrock Wood, Kents Bank, Grange-over-Sands.

EVERY COLLECTOR NEEDS THIS ILLUSTRATED BOOK

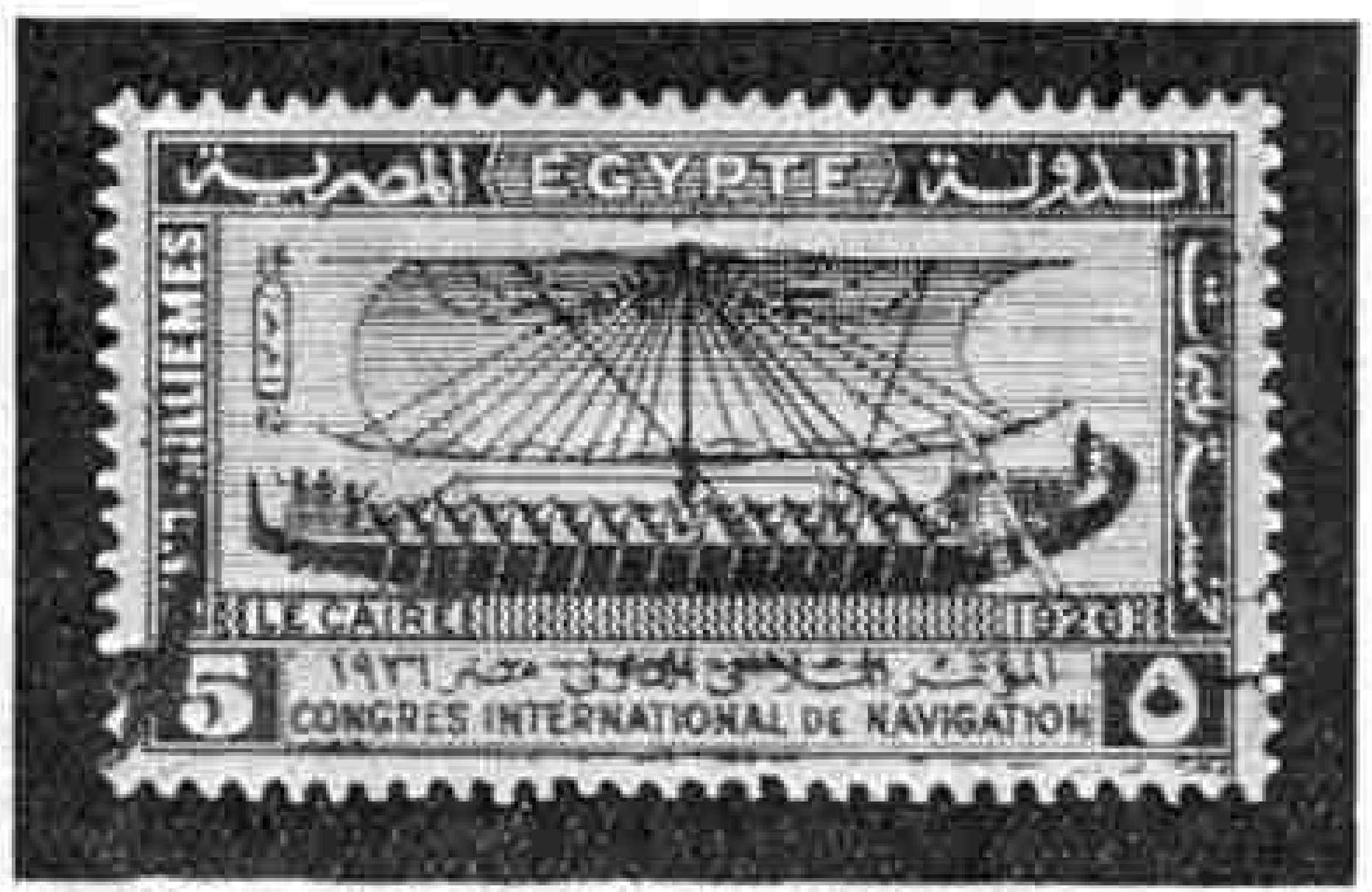
Zoo in a Stamp Album—Ship Stamps—Watermarks—The Aerodrome—Single Country Collections—Olympic Games—Loose-Leaf Albums—Earthquake Stamps—Washing Day in the Stamp World—Three-cornered Market Place—British Empire Albums—Rare Stamps—Overprints and Surcharges—To Correspondents Abroad—Treasure Trove—Triangular Packets—Packets of British, French, Italian, Portuguese, Spanish and German Colonials—Building a Collection—West Indian Packets—Triangular Stamps—Philately Royal—Albums for Beginners—Penny Sets—English Men on Foreign Stamps—Emergency Papers—Shilling Sets—Advertising Stamps—Strip Pocket Books—Glossary—Stamp Tongs—Punctured Officials—etc., etc., etc. These are only a few Headings out of my **NEW SIXTY-PAGE BOOK,** which is **WELL ILLUSTRATED THROUGHOUT** and so full of the right sort of useful and interesting Philatelic information that **EVERY STAMP COLLECTOR MUST HAVE THIS BOOK,** FREE and POST FREE from

EDWARD SANDELL, 10, EVELYN GROVE, SOUTHALL, MIDDLESEX, ENGLAND.



SUBJECT COLLECTIONS

MOST boys who take up stamp collecting set out with the idea of filling their album space quickly; in other words, without realising it, they try to collect every stamp in the world. In a very short time, however, the appalling nature of the task they have set themselves makes itself apparent, and almost every one of those boys experiences a degree of discouragement.

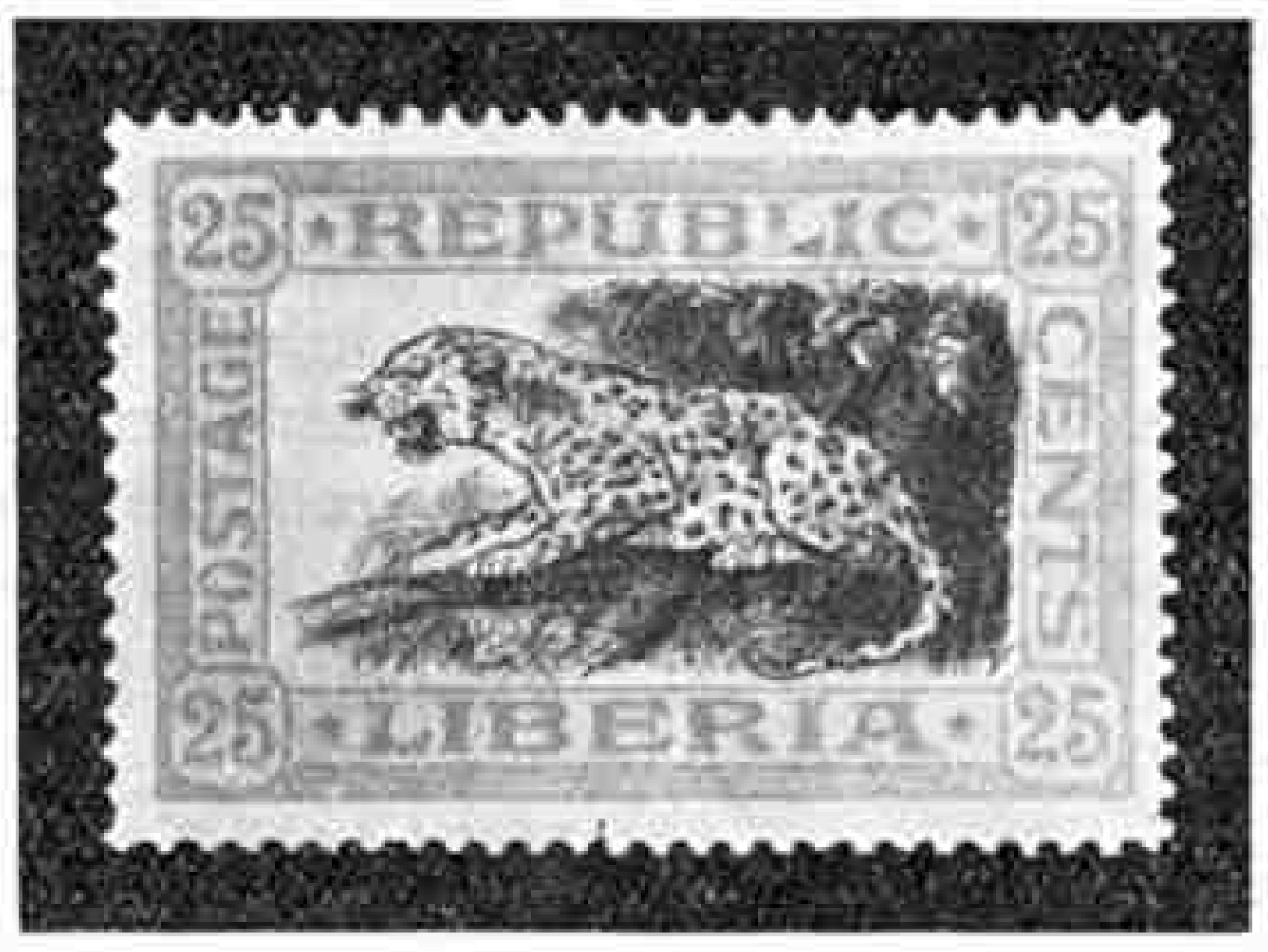


An Egyptian War Galley, illustrating an early stage in the development of warships.

A little advice at this stage often is the means of preventing the young collector from closing his album for ever, and it may prove the inspiration that will lead to the building up of a collection that shall be not only a personal pride to the collector, but also a source of considerable interest to his friends.

Our stamp article this month, therefore, is devoted to suggesting ways in which collectors can direct their stamp collecting in order to compile a collection of never-ending attraction.

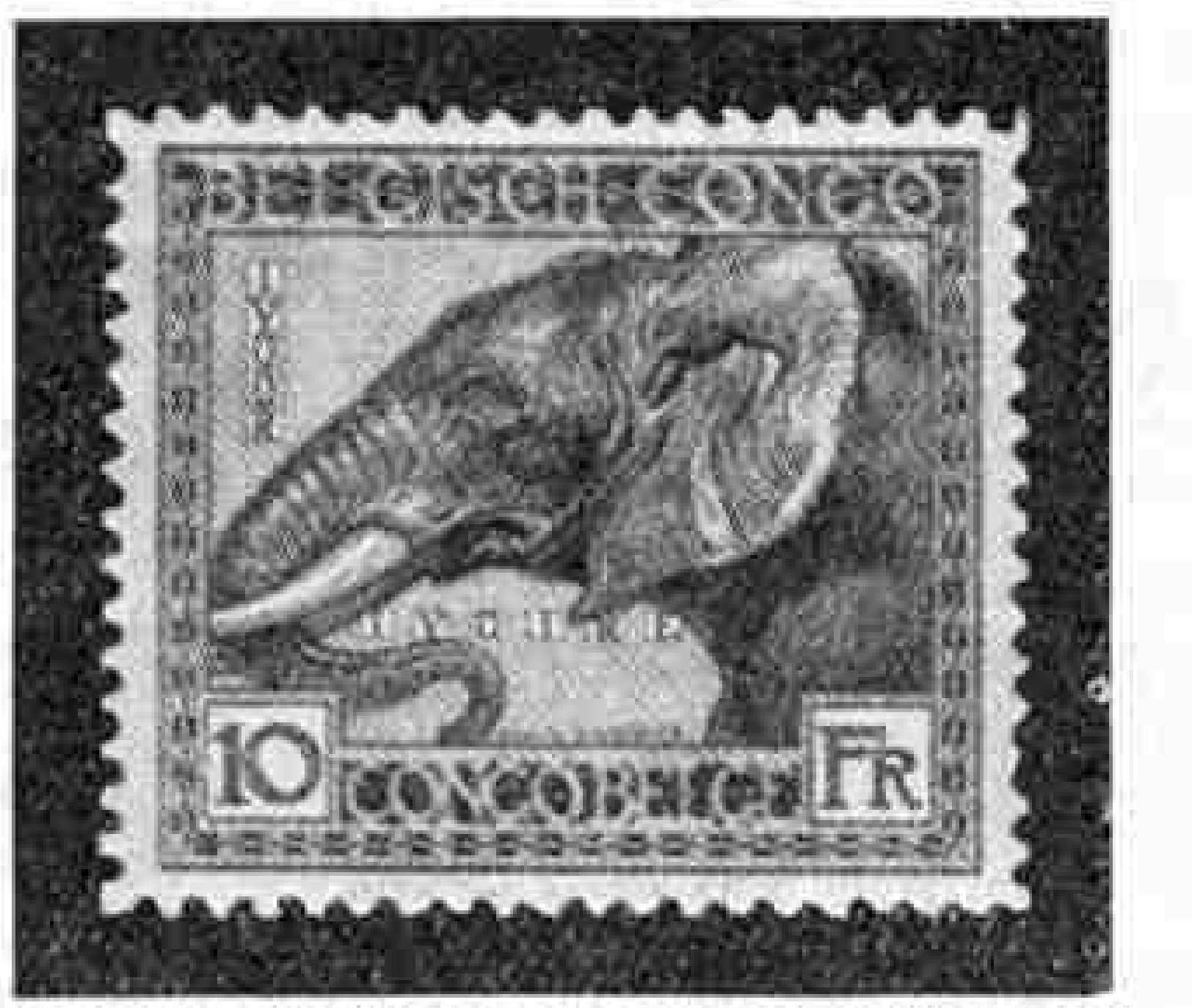
Undoubtedly the average boy's first interest in stamps springs from their attractive colouring and their fascinating designs that reveal to him pictorially the wonders of the world. No matter what other interests a boy may have in life, he can find a series of stamp designs that will enable him to link up that interest with stamps.



This leopard would be an interesting inclusion in a natural history collection.

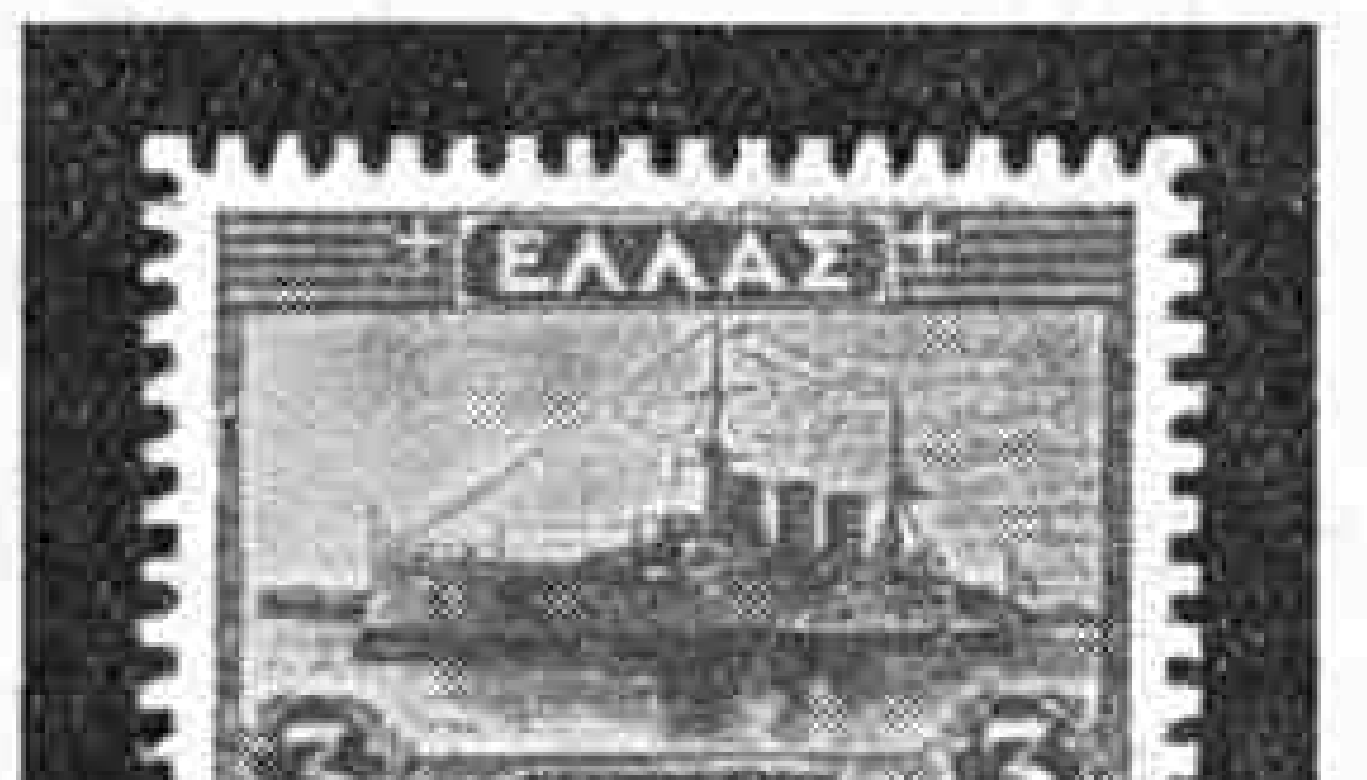
Thus the Meccano boy would find it an excellent idea to make a collection of stamps illustrating the side of engineering that appeals to him particularly—bridge building, railway operation or aviation, for example. We can call to mind readily illustrations of several of the world's most famous bridges, such as the Sydney Harbour Bridge, which was shown in a special commemorative issue produced by Australia in 1932, and the Quebec Bridge, illustrated on the 12c. stamp of Canada's 1928 issue. On Roumania's 5L issue of 1914 there is an interesting illustration of a pontoon bridge constructed by military engineers to facilitate the passage of troops across the Danube. The whole story of bridge building, from primitive rope bridges used by native tribes to cross jungle streams to the mightiest of modern engineering works, can be illustrated in a collection of bridge stamps.

Similarly, the story of the development of aeronautics, both in airships and aeroplanes, from the Wright brothers' first successful flight in 1903 to the world-wide cruises of the Graf Zeppelin, can be illustrated.



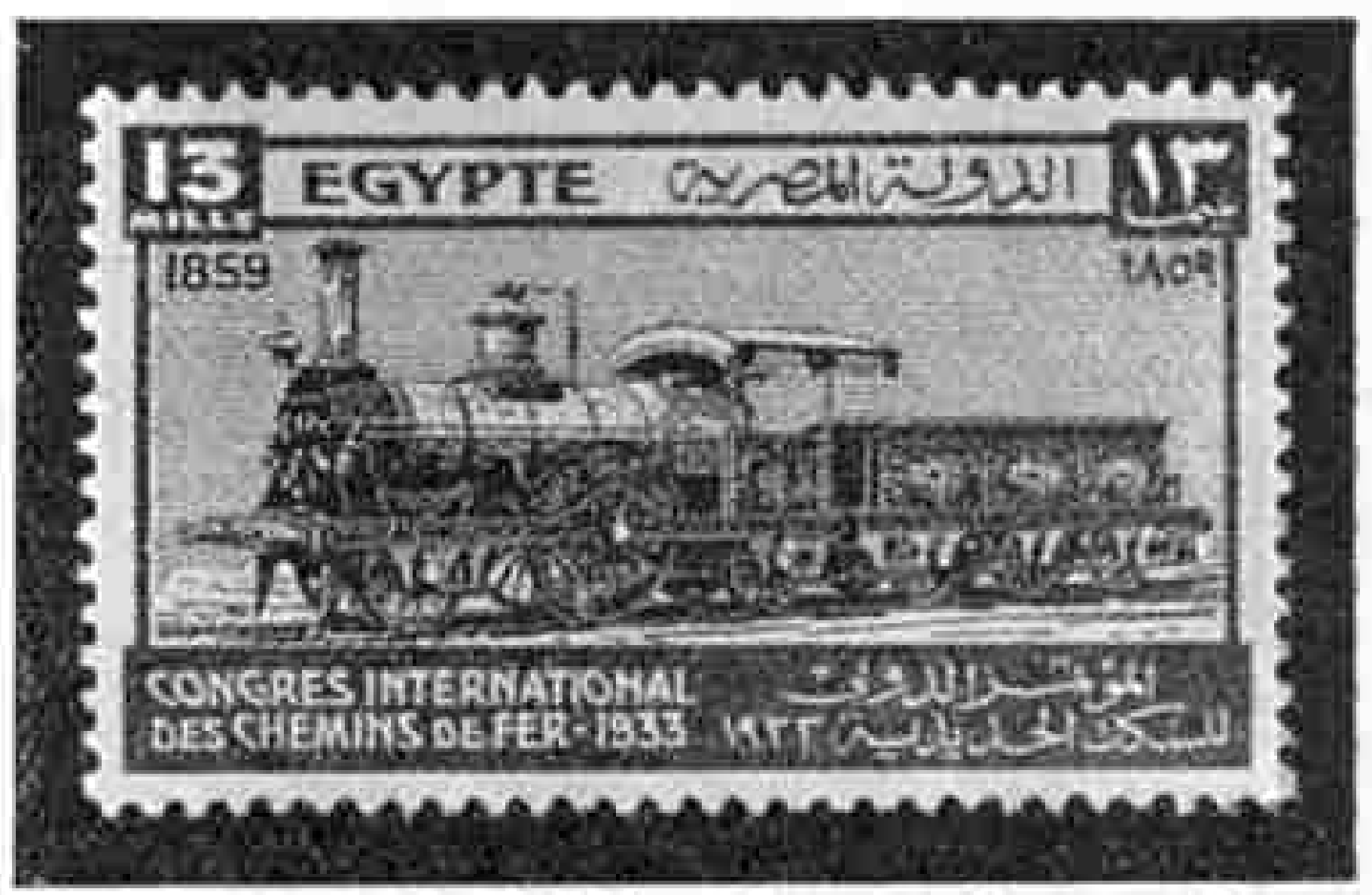
A striking portrait of an African elephant.

Transport through the ages provides another fascinating subject. Indeed the boy who endeavours to cover this subject completely will find himself faced with a quite formidable task. In addition to land transport by horse, post-chaise, automobile and railway, he would have to include also the development of shipping from the tiny caravels of Columbus and Vasco da Gama up to modern leviathans such as the French liner *"Normandie,"* an excellent picture of which appeared on a stamp issued by France early this year to commemorate the vessel's maiden trip across the Atlantic.



The Greek cruiser "Averoff," a further stamp for a war vessel collection.

A boy interested in naval matters would create for himself an engrossing task in outlining the development of war vessels by means of stamps. He will find illustrations of the ancient war galleys of the Egyptians and Carthaginians, vessels of Nelson's day, and a host of material covering modern warships ranging from destroyers to cruisers and dreadnoughts. Turning to non-engineering subjects, those of geographical bent will find an interesting subject in the voyages of Columbus and Vasco da Gama, to mention only two of the more famous early navigators. There have been many issues devoted to men of letters, to musicians and artists. Another fascinating field exists for the boy who is interested in rock and mountain climbing. Most of the world's most famous peaks have been illustrated on stamps of one country and another.



A single wheel drive locomotive used on Egyptian railways in early railway days.

Native customs and national costumes are two other subjects that provide considerable scope. The German charity set issued in October last, two illustrations from which appear on page 759, provides quite an interesting series of illustrations for the latter subject.

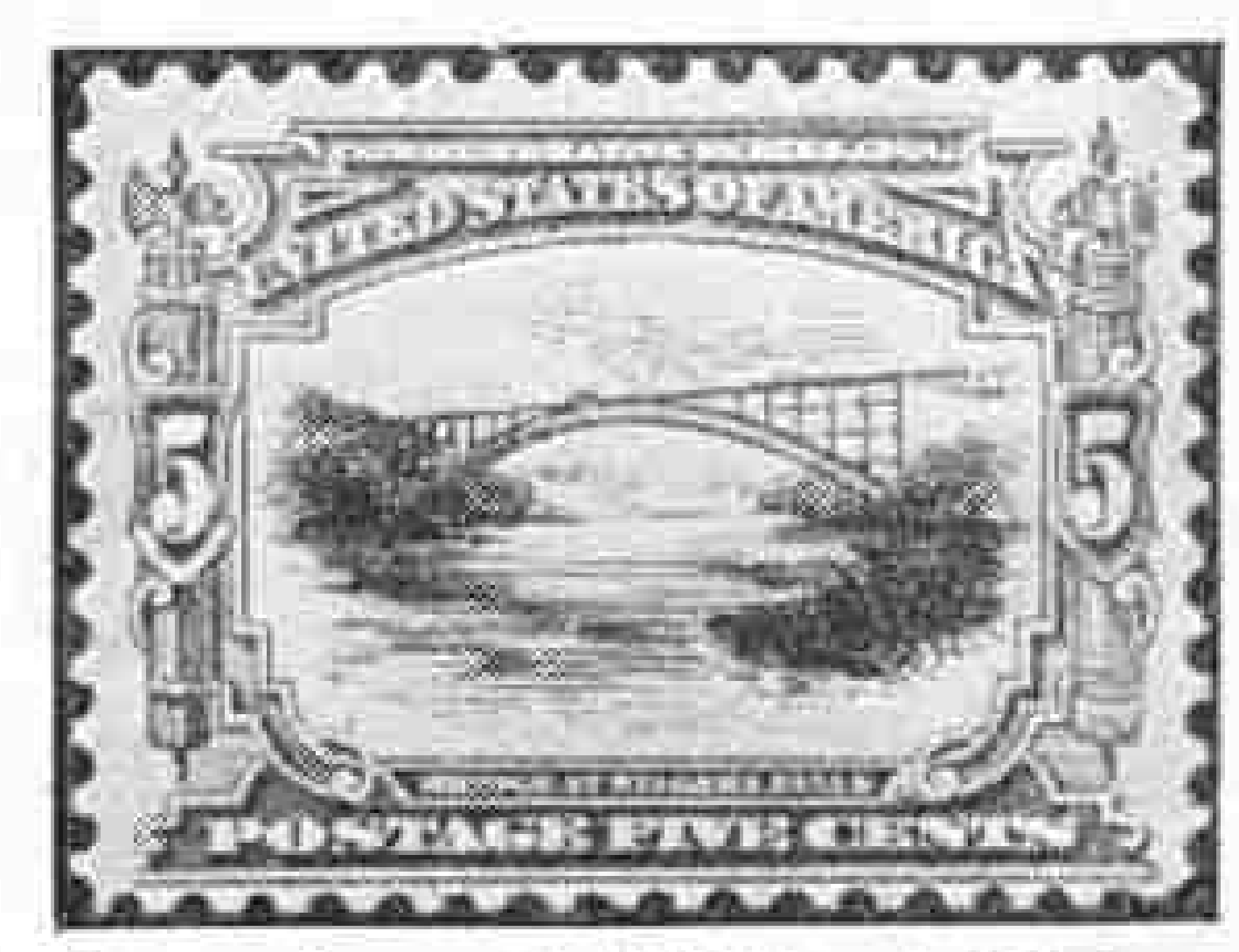
In a short article such as this it is impossible to give a complete list of suitable special subjects, but the few suggestions we have made will be sufficient to convey an idea of the possibilities. A search through the illustrations in any stamp catalogue, or, indeed, among the stamps already in the possession of the collector, will reveal many other possible subjects.

Earlier in this article we remarked that a good stamp collection could prove as interesting to the non-collector as to the collector himself. This is particularly the case with a subject collection, but thought must be given to the layout of the stamps and to the writing up of the explanatory notes that are an essential accompaniment. A fixed leaf album with printed headings is useless for this purpose. A loose leaf album is essential if each phase of the story is to be told and displayed properly.

The actual display of the stamps is a matter of individual taste, and the collector can express his personal ideas with great freedom. The only general principle to be observed is that the pages of the album must not be crowded—from 15 to 20 stamps on a page should be regarded as the maximum—and the arrangement on successive pages must be different so that monotony of appearance is avoided.

In deciding upon the number of stamps to appear on each individual page, due consideration must be given to the amount of explanatory material that is to accompany each stamp. In general we recommend that the explanatory notes should be confined to simple details explaining the design of each individual stamp,

(Continued on page 759



An under-arch bridge at Niagara Falls. This type of bridge is rarely found in engineering to-day.

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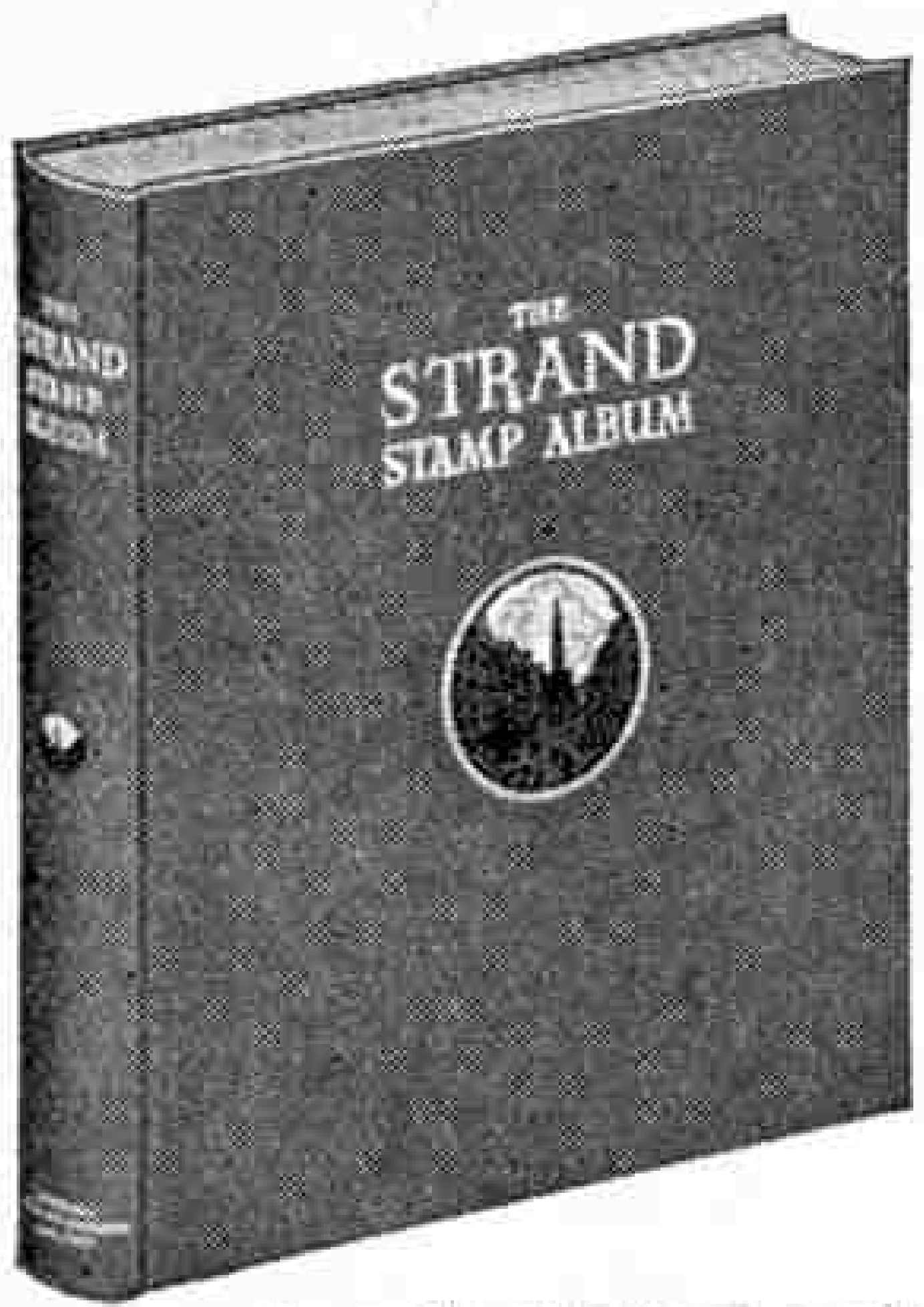

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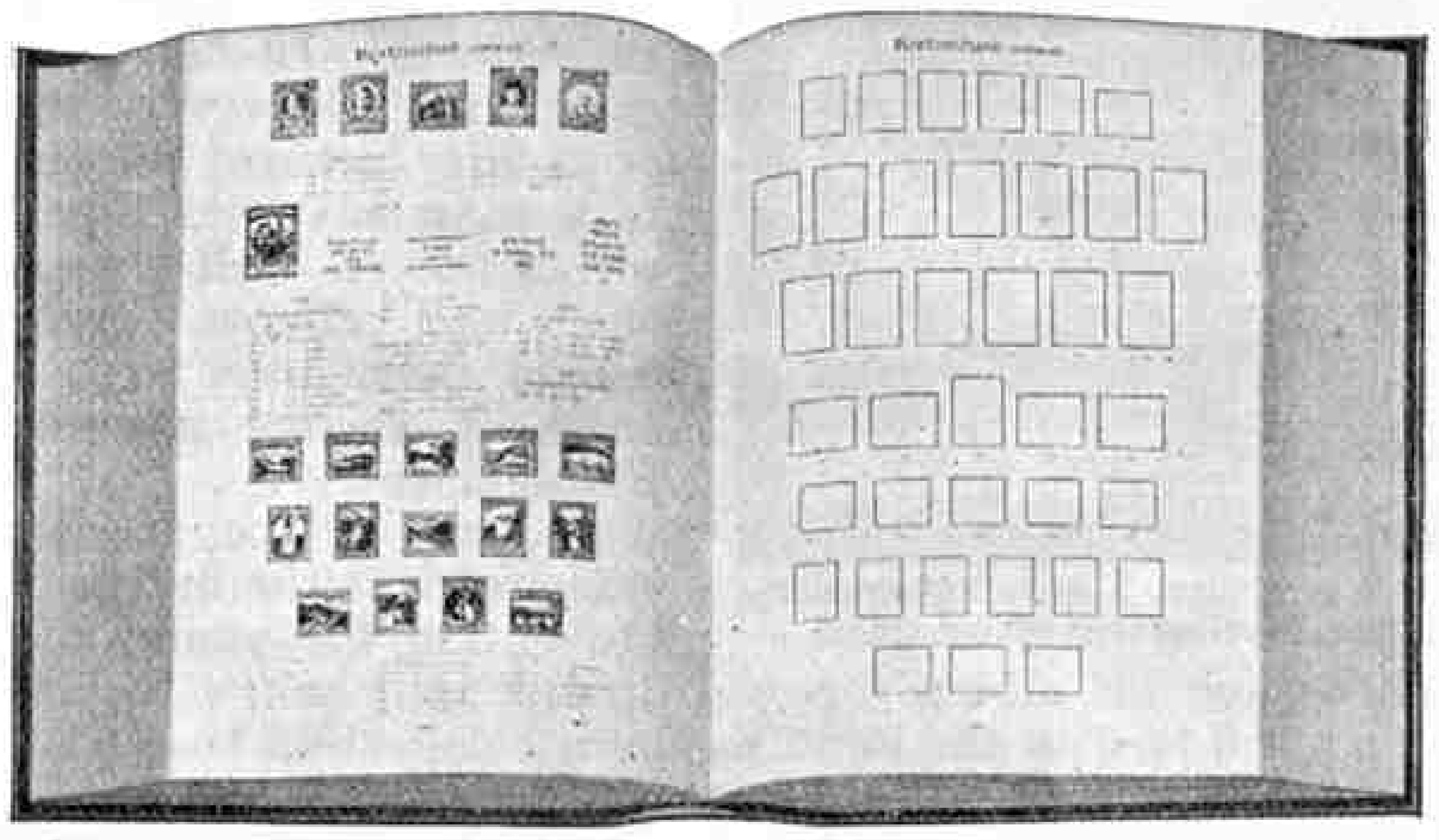

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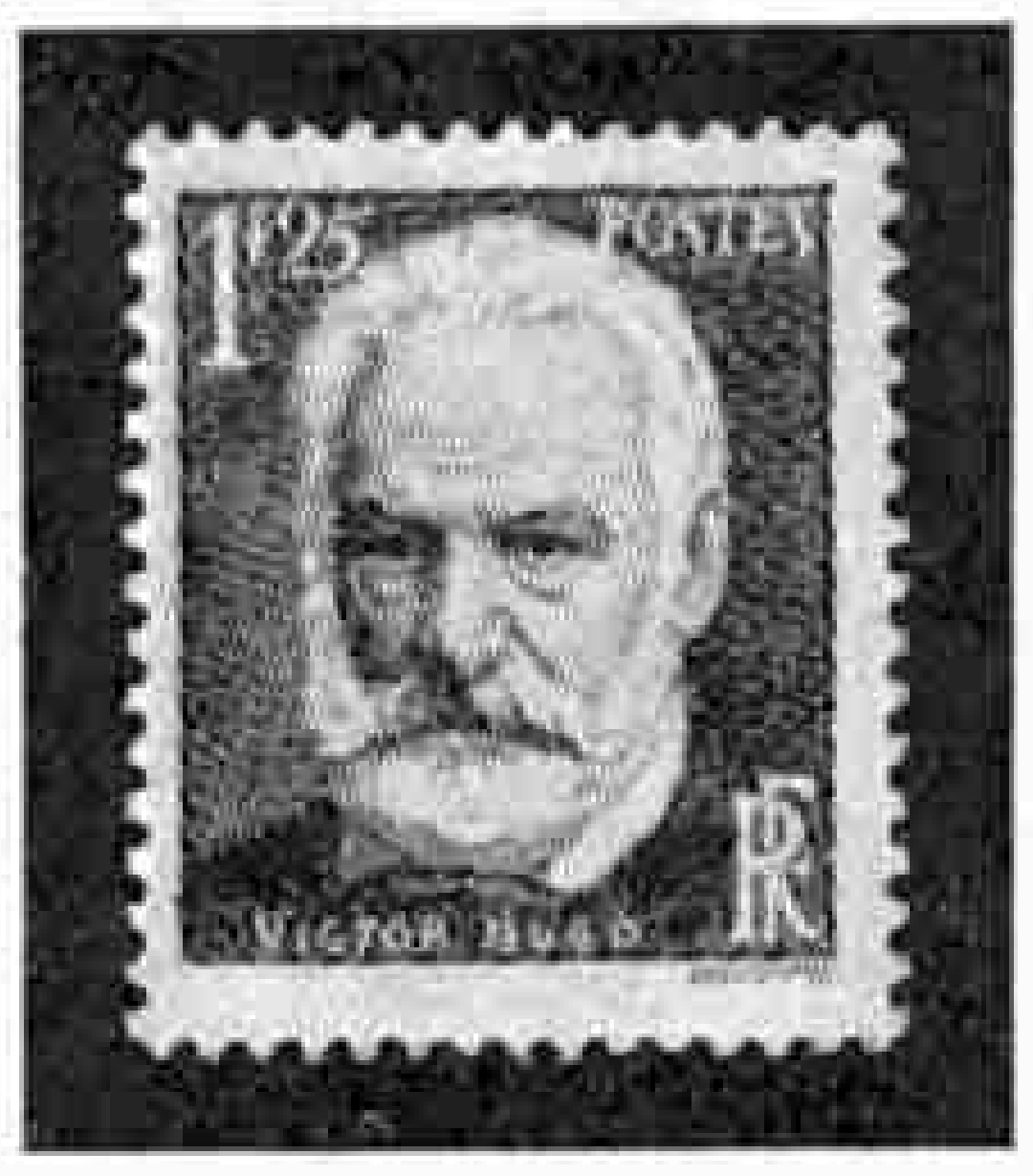
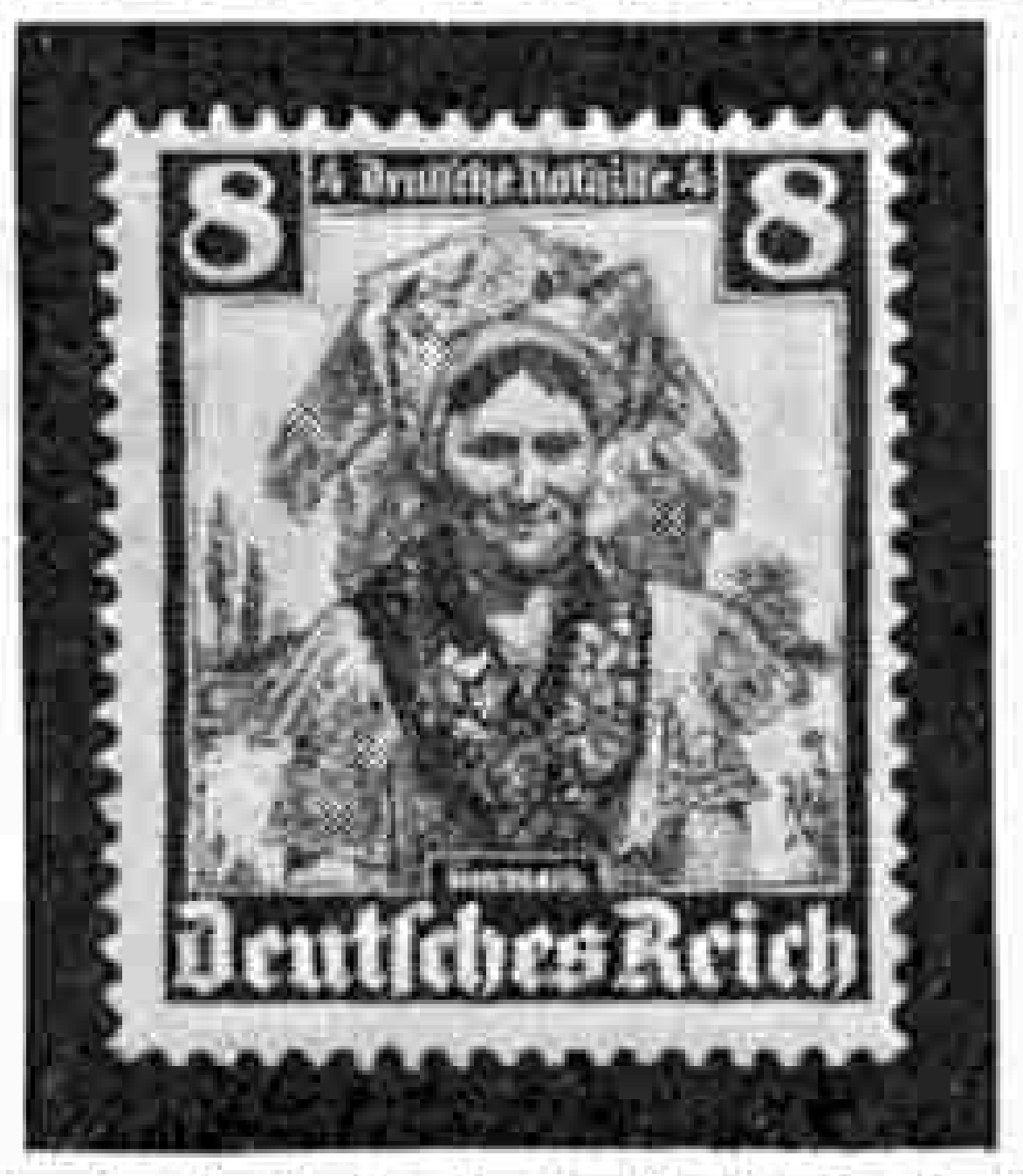


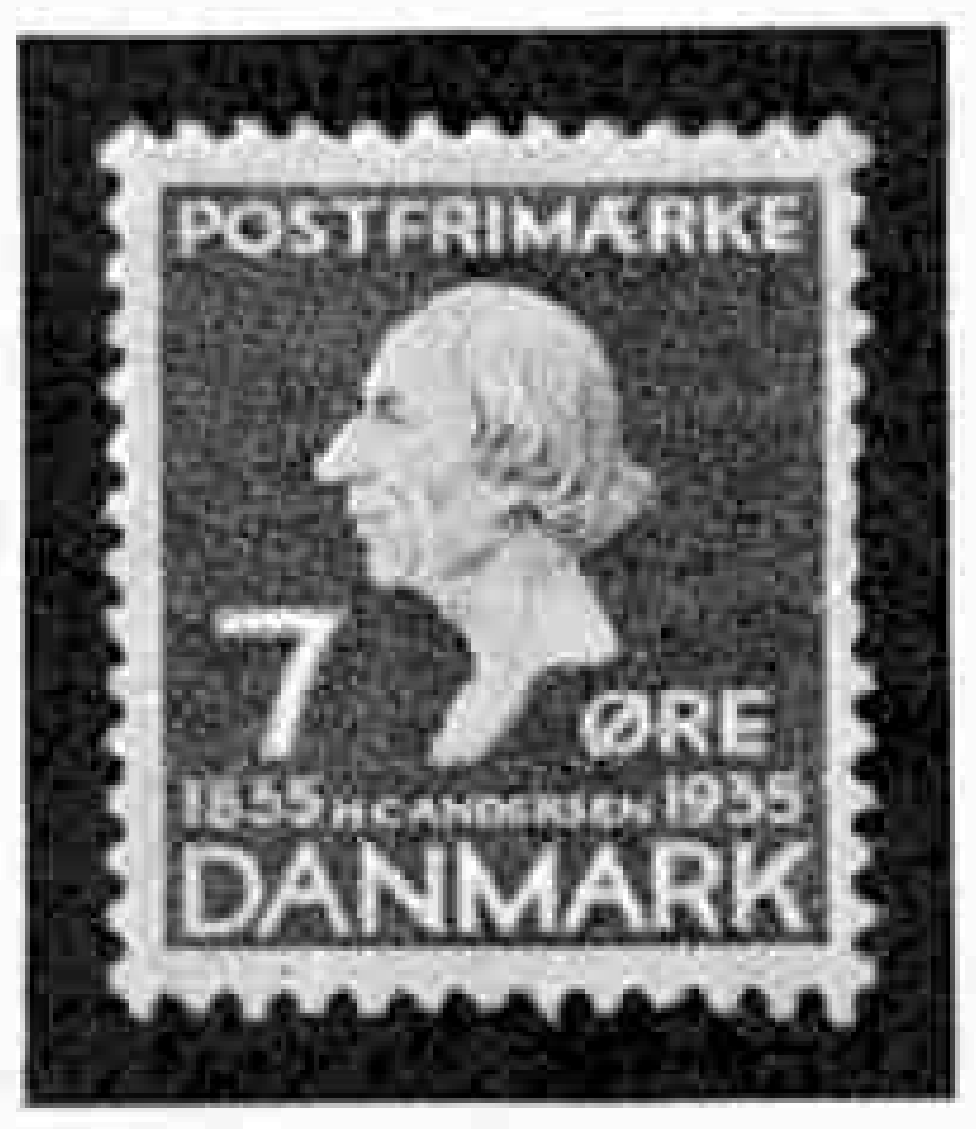
Stamp Gossip

and Notes on New Issues



Fairy Tales Commemorated

The centenary of the first publication of the immortal fairy stories written by Hans Andersen has been marked in Denmark by the issue of a special series of stamps, specimens of which are reproduced here. Hans Andersen, the son of a shoemaker, was born at Odense in 1805, and after having given early promise of brilliance was sent to school and University by generous patrons. Later the Danish Government sent him on a series of Continental tours resulting in the production of a number of brilliantly written travel books.



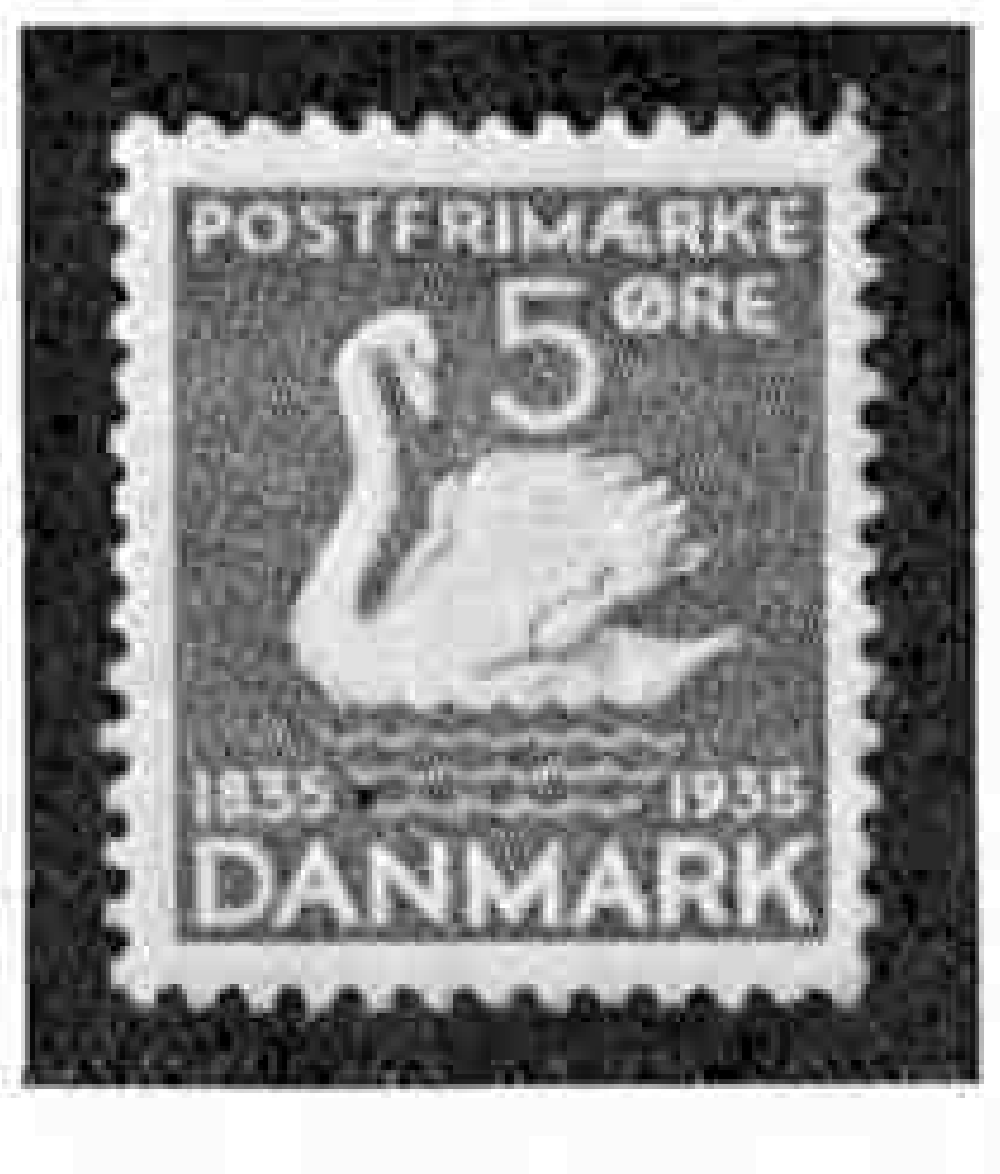
The first series of his famous fairy tales appeared in 1835, others followed at intervals up to 1872, by which time they had won a world-wide reputation. When Hans Andersen died in 1875 his name was known to children in almost every land throughout the world.

The stamp series consists of six stamps, ranging from 5 öre to 30 öre with designs as illustrated here. The portrait is used on each of the 7, 15, 20 and 30 öre values. The story of "The Wild Swan" is symbolised on the 5 öre value and "The Little Mermaid" on the 10 öre stamp.

Stamp Collecting—*(Continued from page 757)*

with the addition of very brief notes linking together successive stages of the development of the story.

Thus, in writing up the Sydney Harbour Bridge stamp, to which reference was made earlier in this article, it would be sufficient to say: "Sydney Harbour Bridge, New South Wales. Completed 1932. The world's largest arch bridge. Length of main arch span, 1,650 ft. Total weight of steel in five northern and five southern approach spans, and main span, 50,200 tons. Width of bridge, 150 ft. Highest point of arch, 445 ft. above high water. Clearance under bridge at high water 172 ft. Traffic capacity 160 trains, 6,000 road vehicles and 40,000 foot passengers per hour."



Before each note is committed to the album, however, the complete wording should be decided upon. It is very disappointing, after taking great pains to achieve a neatly written paragraph, to discover that the phrasing and sequence of data leaves something to be desired.

In the near future we hope to be able to deal in greater detail with the matter of subject collections, but in the meantime readers who are interested, and desire guidance in making an early start, should write to the Editor of the "*M.M.*" who will be glad to help them.

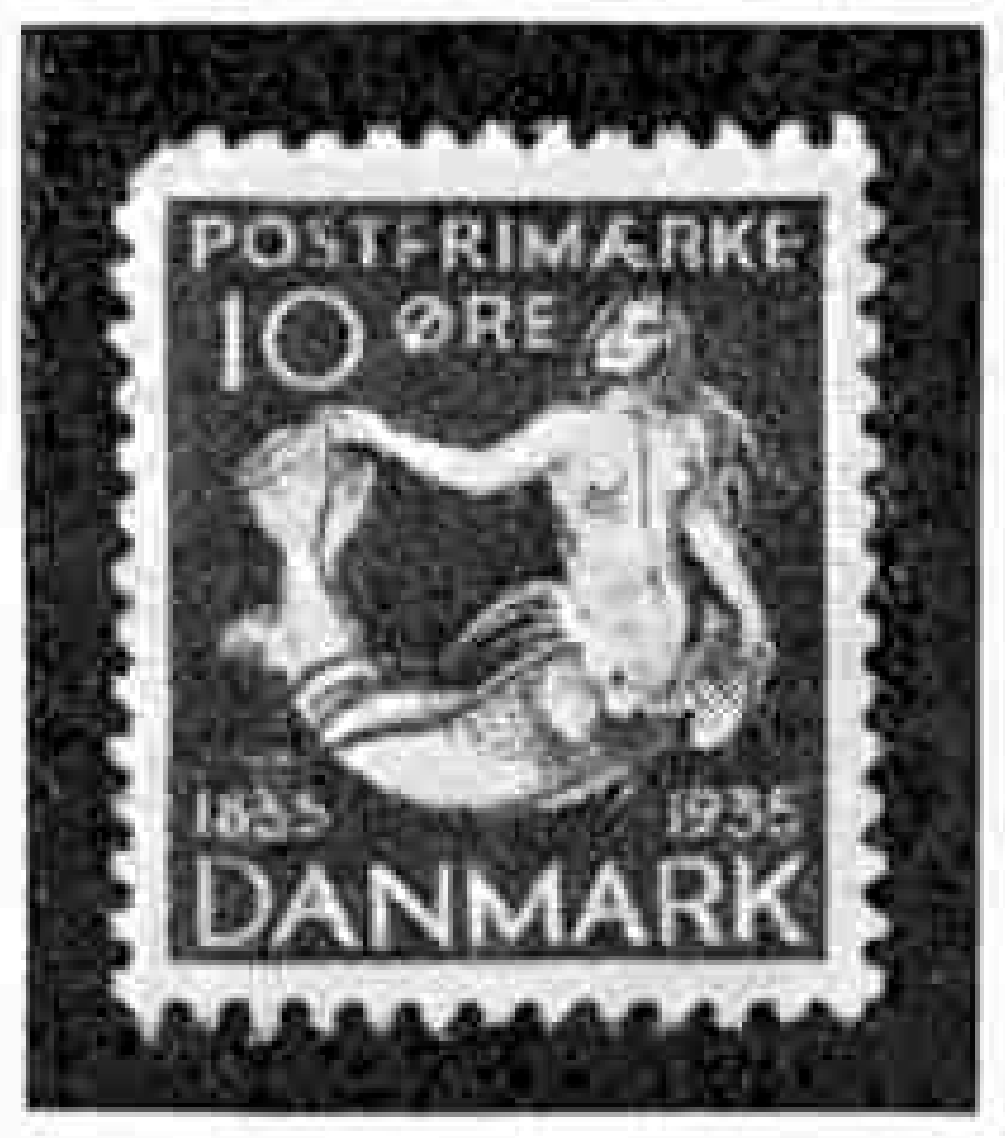
Christmas Seals

Many of our readers have written to us, at various times, to ask whether the "stickers" issued by National associations for fighting the tuberculosis scourge have any stamp collecting value.

Actually they are of no interest as stamps, but their association is so close that at this season we feel it would be appropriate to tell the very charming story of their birth. No fairy tale conceived by Hans Andersen is more beautiful, and strangely enough it was a fellow Dane, Einar Holboell, who was responsible for the first Christmas Seal.

Einar Holboell was a postal official, and was touched by the sight of little children, living in the poorer district of his town, who were suffering from that terrible disease, tuberculosis. He saw thousands and thousands of letters coming into and going out of his post office at Christmas time, and suddenly the idea came to him that it would be wonderful if every one of those letters meant a halfpenny with which to fight tuberculosis.

"Suppose," he said to himself, "a stamp could be designed—not a regular Government postage stamp, but a specially decorated stamp—to sell for a half-penny, something that people could buy and put on their Christmas letters and packages; the money from the sale of those stamps could be used to build a hospital in Copenhagen for treating children with tuberculosis."



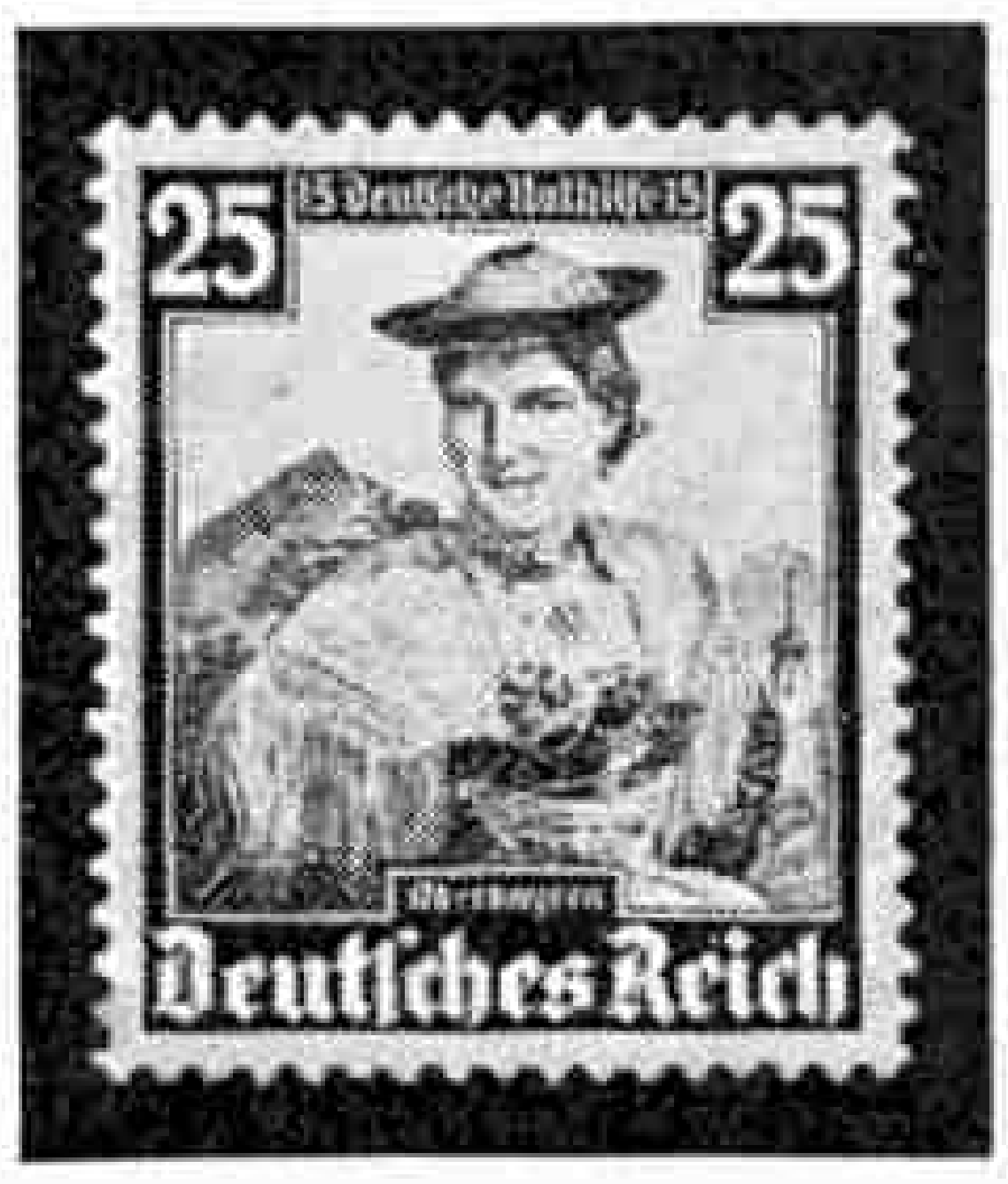
He approached the King and Queen of Denmark for help, and the result was that not only did Denmark adopt the idea, but nearly every country in the world is now selling special stamps to raise funds for the purpose of fighting the children's most deadly enemy.

Three years ago the first Christmas Seal, sponsored by the National Association for the Prevention of Tuberculosis, was sold in England, and this year there will be millions of these gay little messengers going through the post on the backs of Christmas letters and on packages. Each one bears the Season's Greetings, and represents a girl standing in the snow with outstretched arms beneath the double-barred scarlet cross, which was first displayed on the banner of Godfrey de Bouillon, a famous leader of the First Crusade, and which is now the international emblem of all bodies of anti-tuberculosis workers.

Those of our readers who are desirous of supporting the scheme may obtain supplies of the Seals from the National Association for the Prevention of Tuberculosis, Tavistock House, North, Tavistock Square, London, W.C.1, or from their local Branch Association.

Stanley Gibbons' Simplified Catalogue

The present phenomenal "boom" in stamp collecting is certainly due in great part to the world-wide popularity of the numerous Silver Jubilee issues, but credit must be given also to those parts of the Empire that have had the wisdom to produce attractive and beautiful stamps instead of using the monotonous standard designs of the past. They are making their scenery, history, and products known to the world at large.



The issues of foreign countries too show that there is an ever widening appreciation of the interest value of attractive stamp designs, and thus among the new foreign issues of 1935 we find pictorial associations with almost every subject under the sun. Unusual designs include the liner "*Normandie*," an oil well, gold mining, and two very early railway engines. Scenic designs range all over the globe, from Mt. Hekla in Iceland to the Taj Mahal in India. Among famous people referred to are Bach, Handel and Dvorak, in the realm of music, Victor Hugo in literature, and Cardinal Richelieu in statesmanship.

With such variety it is not surprising that many collectors nowadays are content to regard their stamps as a pictorial record of the world they live in, and the Gibbons' Simplified Stamp Catalogue is their ideal guide, for not only are its illustrations full-size, but the subjects of the various designs are described. This year 39 extra pages are required to accommodate the latest issues—a matter of 1,700 additional stamps—making a grand total of 54,000 different stamps listed, and 6,800 full size illustrations.

The catalogue may be obtained from any stamp dealer, price 5/– net, ordered from Stanley Gibbons Ltd., 391, Strand, W.C.2.

German National Costumes

As the two illustrations on this page show, the designs for Germany's 1935 Winter Relief charity stamps comprise a most interesting range of illustrations depicting German national costumes.

The full series is as follows: 4pf. Silesia; 5pf. Rhine Province; 6pf. Lower Saxony; 8pf. (illustrated) Kurmark; 12pf. Black Forest; 15pf. Hesse; 25pf. Upper Bavaria; 30pf. (illustrated) Friesland; 40pf. Franconia. The stamps are to be sold at premiums ranging from 2pf. to 35pf.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations on this page have been made.

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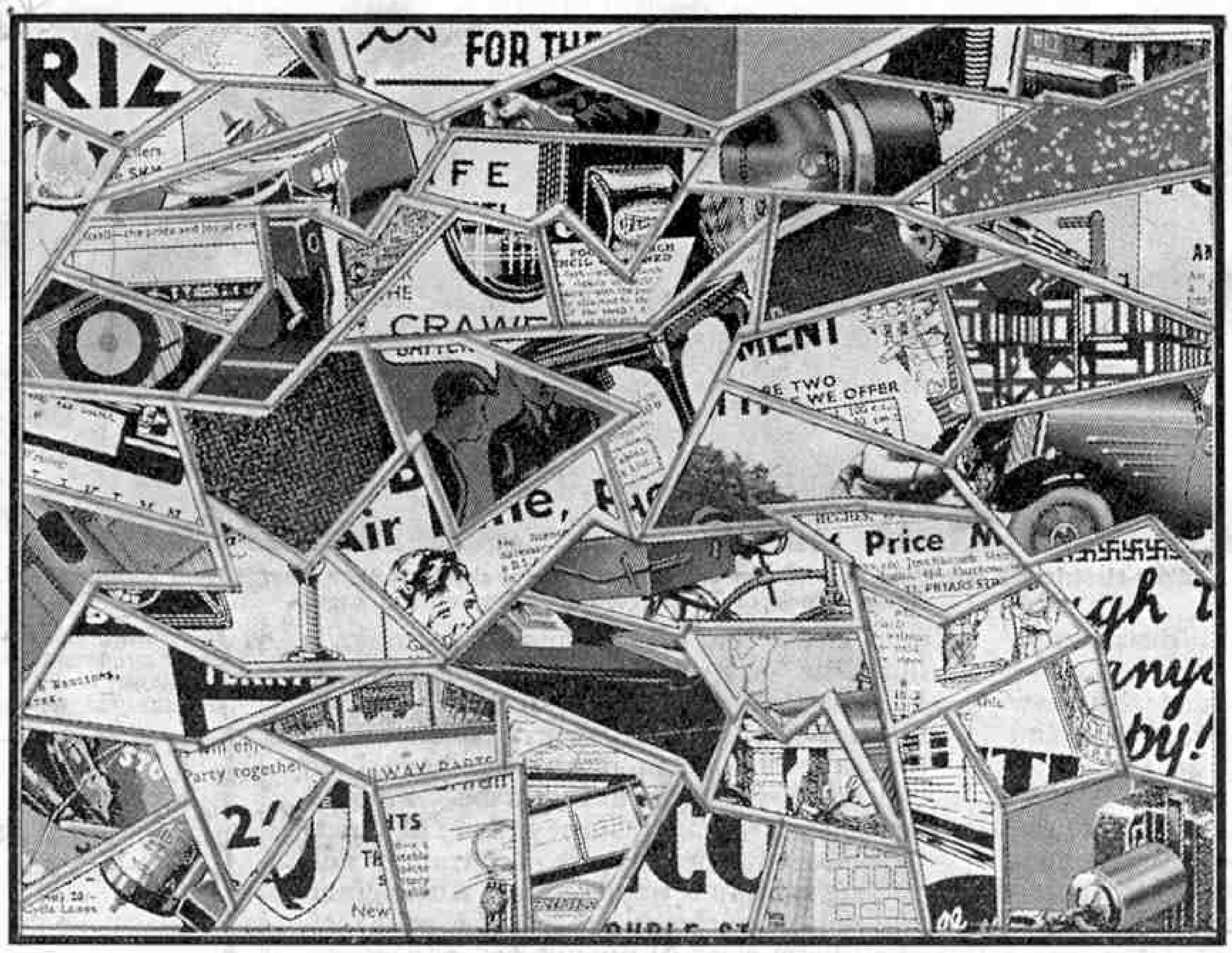
Competition Corner

ADVERTISEMENT "JIG-SAW" CONTEST

The advertisements in the December *"M.M."* are, for the average boy, as important as the Editorial pages. When Christmas presents are to be selected there is a fascinating wealth of interest in the advertising pages.

In repeating the "Advertisement 'Jig-Saw' Contest" that has proved so very popular in recent December numbers, we feel sure that our readers will find the problem of sorting out the advertisements represented in the accompanying picture a most amusing occupation, and, for a number of lucky readers, a profitable one.

The picture consists of 51 fragments that have been cut from the advertisements appearing in this issue of the *"M.M."* and our readers are invited to discover the names of the advertisers from whose advertisements the fragments have been taken. Some of the pieces will be easily traceable, but others will prove not quite so easy and, candidly, we hope they will tease our lynx-eyed readers more than a little. It is a very long time since we succeeded in setting a puzzle that could not be solved by more than a few of our readers!



It should be noted that when an advertiser has more than one advertisement in this issue, the number of the page from which the fragment is taken must be stated in the entry.

Cash prizes of 21/-, 15/-, 10/6 and 5/- respectively will be awarded to the senders of the four most accurate lists in order of merit. In addition there will be a number of consolation prizes.

Entries for the competition must be addressed to "Jig-Saw Advertisement Contest, Meccano Magazine, Binns Road, Liverpool 13," and must be forwarded to reach this office not later than 21st December. The prizes will reach the winners on Christmas Day.

Another set of prizes, of the same value and to be awarded in similar conditions, will be allotted to the Overseas section, which is reserved for entries from readers living outside Great Britain, Northern Ireland, the Irish Free State and the Channel Islands. Entries for the Overseas Section should be mailed to arrive not later than 31st March, 1936.

Christmas Letter Contest

Christmas is undoubtedly a festival of youth, but nevertheless we doubt whether any two boys would give quite the same answer were they asked what they liked best about Christmas.

Some boys would plump for the excitement of giving and receiving surprise presents; others would like most of all the thrilling preparations, bringing in and hanging the decorations; and for others the parties are the high spot of the season's thrills.

It would be interesting to have our readers' views, and therefore we are offering prizes of 21/-, 15/-, 10/6 and 5/- for the four most interesting letters from readers on the subject *"What I Like Best About Christmas."*

Letters should not exceed 250 words in length and should be addressed to "The Editor, Meccano Magazine, Binns Road, Liverpool 13." They must arrive not later than 21st December. Overseas entries, for which similar prizes will be reserved, must arrive not later than 31st March, 1936.

December Drawing Contest

For our drawing competitions this winter we have decided to give our readers a free choice in the matter of subjects, and accordingly prizes are being offered each month for the best drawings or paintings submitted, irrespective of subject, size of the entry, or method of production.

Each month's entries are divided into two sections, A for those aged 16 and over, B for those under 16, and prizes of 21/- and 10/6 respectively, are awarded in each section.

A separate set of prizes is reserved for entries from Overseas readers, to be awarded in precisely the same conditions.

Entries to the December Contest must be addressed "December Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 21st December. Overseas closing date, 31st March, 1936.

Unsuccessful entries will be returned if a stamped addressed cover of suitable size is sent with the entry. Prize-winning entries become the property of the Editor.

COMPETITION RESULTS

HOME

September 'Sketchograms' Contest.—First Prizes: Section A, R. E. Billinge (Patcham); Section B, D. Briault (Brighton). Second Prizes: Section A, K. J. Smith (Carlton); Section B, J. S. Taylor (Burnley).

September Photo Contest.—First Prizes: Section A, A. R. Bishop (Bristol 4); Section B, R. F. Y. Randall (Oxford). Second Prizes: Section A, E. Haywood (Carlton); Section B, A. Large (Alloa).

October Doublets Contest.—1. B. H. Lloyd (Bangor, N. Ireland); 2. W. F. Parker (Braughing, Herts.); 3. G. E. Gaunt (Chesterfield); 4. K. Willson (Dartmouth).

October Drawing Contest.—First Prizes: Section A, K. Costain (Bolton); Section B, A. Kelton (Carlisle). Second Prizes: Section A, N. S. Griffiths (Gidea Park, Essex); Section B, W. K. Cocking (Redruth).

OVERSEAS

June Photo Contest.—First Prizes: Section A, J. Credie (Capetown); Section B, C. T. Johnson (Cape, S. Africa). Second Prizes: Section A, E. Worthington (Vancouver, B.C.); Section B, E. Jones (Perth, Australia).

July Photo Contest.—First Prizes: Section A, C. J. McCain (Sydney); Section B, R. G. Williams (Vancouver, B.C.). Second Prizes: Section A, J. Credie (Capetown); Section B, P. Demanuele (Hamrun, Malta).

July Crossword Puzzle.—1. J. M. Demanuele (Valletta, Malta); 2. G. S. Davies (Dunedin, N.Z.); 3. D. Tolkowsky (Palestine); 4. D. Waugh (Johannesburg, S.A.).

MORE BOOKS TO READ

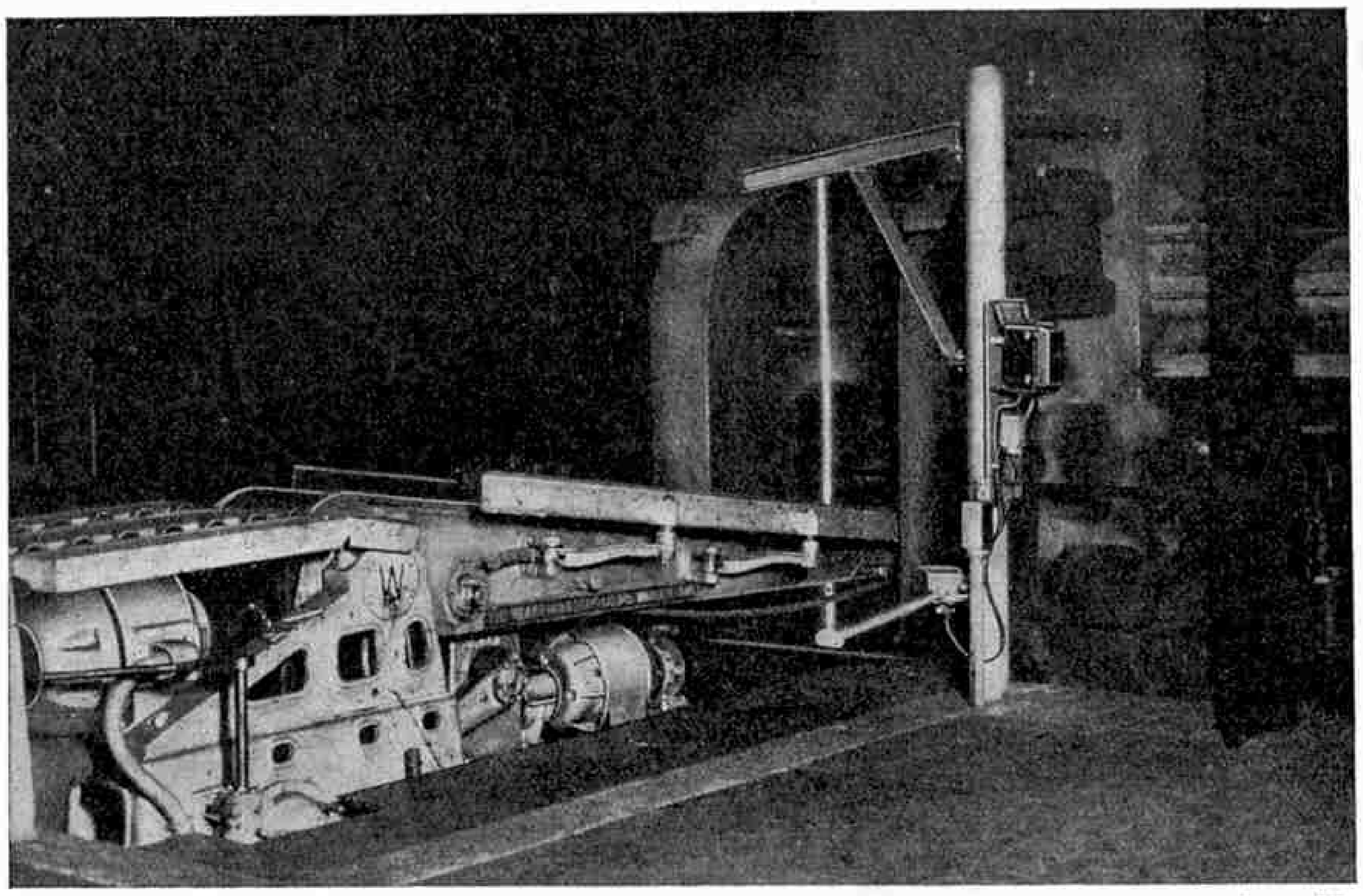
(Continued from page 731)

"Tools of To-morrow"

By Jonathan Norton Leonard
(Routledge. 12/6 net)

The author tells us that there is an abundance of information being released from industrial research which we have not yet learned to . Much of this exist now only on paper or in the minds of scientists, but many ideas are already proved and tested, and merely await the appropriate moment for release. These contributions from research are gradually being absorbed into our general knowledge, so that we hav the prospect of th dreams of yesterday becoming the tools of to-morrow.

The book takes us for a tour through the realms of energy—sources such as water and tidal power, volcanic, wind and solar power—and then sets us down to make use of them with all the accumulated contributions of science at our disposal. Following this we find ourselves using the latest types of power supply and distribution plants.



A photo-electric cell operating a device for catching hot metal sheets as they emerge from a rolling mill. (From "Tools of To-morrow" reviewed on this page.)

There is a chapter dealing with new alloys and their microscopic analyses, and some very interesting notes on the metal beryllium, which has the rigidity of steel and is lighter in weight than aluminium. There are chapters on production machines, the organisation of machines and the possibilities of mass production, including photo-electric control and so forth.

A considerable portion of the book deals with improvements to transportation, as for instance the streamlining of vehicles for sea, land and air, and many additions to the comfort of the traveller. In the concluding chapters there are some notes on both wired and wireless electrical communication and television, and other advantages applied science offers us.

The book, which is illustrated with a number of well-chosen photographs, is full of material that will interest every thoughtful reader.

"Lawrence of Arabia"

By R. H. Kiernan. (Harrap. 3/6 net)

In the autumn of 1934 Mr. Kiernan set out to write for boys the wonderful story of Lawrence of Arabia, and hoped to publish it with Lawrence's sponsorship. On the day of Lawrence's fatal accident Mr. Kiernan received from him a letter which may be the last he ever wrote. In this he said: "Most children are fed up with the War and the inclination (amongst its survivors) to treat it as a matter of significance. I sympathise with them: the last war is always a bore to the next generation." This may be true of the War in general, but Lawrence's striking adventures and the Arab revolt are exceptional, and that is the special reason for the appearance of this book. The author gives a clear and vivid account of the man himself and his thrilling exploits, and of what it was he aimed to do. The book contains maps and interesting illustrations.

Adventure Stories

(Frederick Warne)

The output of adventure stories seems to become greater each year, and one of the most industrious of their writers is Capt. F. A. M. Webster. His book *"When Strange Drums Sound"* (3/6 net) describes the amazing discoveries and weird experiences of a party of Englishmen and Americans who enter the African jungle to make a film. The *"Mountains of the Moon"* by C. T. Bridges (1/6 net) is also an African story, but in this case concerns an exciting search for some traders in ivory who have been captured by a fierce native tribe. *"Through the Never-Never"* by Gurney Slade (2/6 net) tells how an American, two Australians and an Englishman set out to cross Australia in two motor trucks, in search of a gold reef. They have a lot of unexpected adventures before they find the gold.

Sea stories are always popular, and *"The Roving Traders"* by Walter Wood (2/- net) is an account of an exciting voyage in the *"Dumbarton,"* an old tramp ship that is reconditioned and given a new lease of life. *"Noel Howard, Midshipman"* by Vice-Admiral Sir E. R. G. R. Evans (6/- net) is a thrilling story of the sea in the days when Nelson was leading his ships against the French, and also presents an authentic picture of life in the Navy at that time.

Another striking historical novel, this time concerned with adventure on land, is *"The Refugee"* by Major Charles Gilson (2/6 net). It relates the daring deeds and narrow escapes of Jack Drummond, a bold highwayman, who eventually is captured.

The Wilco Range of Cycle Lamps

Those of our cyclist readers who indulge in night-riding will find much to interest them in the range of lighting equipment in the Wilco 1936 list, and particularly in the new Wilco de Luxe dynamo sets, fitted with handlebar or lamp control switches. The dynamo included in the set incorporates many up-to-date ideas in small dynamo construction, and a special feature is voltage control that eliminates the possibility of bulb breakage when cycling at high speed. Messrs. L. Wilkinson and Co., 8, City Road, London, E.C.1, will send full details of this and other cycle lighting equipment to any reader who writes mentioning the "*M.M.*"

New Grips for Webley Air Pistol

For a considerable time the shape of the grip of the Webley Air Pistols, although it did not detract from accuracy, has been subject to criticism. It is of interest to our sporting readers, therefore, to know that the makers, Webley and Scott Ltd., have now been able to introduce a new type of grip for their Mark I and Senior Models. The new grip, in addition to improving the general appearance of the models, gives greater comfort in use and will materially add to the efficiency of the pistols. Interested readers can secure a copy of a descriptive leaflet on application to Webley and Scott Ltd., Weaman Street, Birmingham, 4, free of charge on mentioning the "*M.M.*"

Cinema Shows at Home

The efficiency of home cinema equipment has rapidly improved in recent days and there is now a very wide selection of first-class films available. The Bingoscope, advertised elsewhere in this issue, is a typical instrument, low priced but thoroughly efficient. Its makers claim for it that it sets a new standard of quality and reliability in home cinema construction. It is fitted with a double claw action with synchronised double shutter that gives a perfectly steady picture without the slightest trace of flicker. Fine quality condenser and focussing lenses are incorporated to ensure a clear, sharply-defined image right up to the edge of the screen. Battery and mains models are available. The Bingoscope service also provides a big range of films suitable for home entertainment, such as Mickey Mouse, Silly Symphony and Harold Lloyd features.

Our advertisers, Messrs. L. Rees and Co., 12, New Union Street, London, E.C.2, will send full details to any reader who writes mentioning the "*M.M.*"

Coupons in Advertisements

Those readers who dislike mutilating their magazines in cutting out advertisement coupons should note that a simple letter to the advertiser concerned will serve instead of the coupon, but the "*M.M.*" must be mentioned in the letter.

Harrap Books for Boys

Epic Tales of Modern Adventure

By BRIDGES and TILTMAN. Illus. 7/6

Narratives of exploits ranging from Dr. Beebe's exploration of the ocean depths to the Citroën motor expedition across the Himalayas and the wreck of "Sinbad" on a barren islet in the Indian Ocean. "All seventeen yarns are superb."—*Boy's Own Paper.*

Lawrence of Arabia

By R. H. KIERNAN. Illus. 3rd Impr. 3/6

"Those of you who are seeking a clear and very readable account of the revolt of the Arabs, with Lawrence's striking figure dominating it all, will find satisfaction in R. H. Kiernan's very able book."—*Boy's Own Paper.*

The Boy's Romance of Aviation

By CAPT. A. O. POLLARD, V.C. Illus. 7/6

Traces the progress of aviation from the earliest legends to the present day, tells of the influence of the War, the story of Atlantic crossings and long-distance flights, etc., and explains the construction and equipment of aircraft.

From all booksellers

HARRAP

182, HIGH HOLBORN, LONDON, W.C.1

Fireside Fun

NOT WHAT HE EXPECTED

A tramp entered the gates of a villa, knelt down on the lawn and began to eat the grass. The old lady who lived in the villa came out on to the doorstep and said: "My good man, are you so hungry that you are obliged to eat grass?"

"Yes, ma'am," replied the tramp.

"Oh, dear!" said the lady. "You may go round to the back garden, the grass is longer there."

* * * *

"Is this a second-hand shop?" asked a small boy.

"Yes, my lad. What can I do for you?"

"I want a second hand for my watch, please."

* * * *

A man entered a railway carriage and placed a large case on the rack. The man seated beneath it looked up nervously. "Do you think your case is safe?" he asked.

"Yes, it's locked," the other replied.

* * * *

Swiss Guide: "The echo here is so good that people shout out of their windows when going to bed and the echo wakens them in the morning."

* * * *

Sambo: "Why does the Sun go south in the winter, Rastus?"

Rastus: "Can't say, ol' friend, unless he can't stand de cold weather in de north and so goes south where it is warmer."

* * * *

"I see that an explorer in the Congo Free State has discovered a new tribe, the men of which beat the ground with sticks as a sign of anger."

"Dear, dear. Fancy golf spreading to Central Africa!"

* * * *

Old Lady: "This room is very stuffy, I really must get one of those wireless fans I read about in the newspapers."

* * * *

Man (using road drill): "I wish you'd stop humming, George, you get on my nerves."

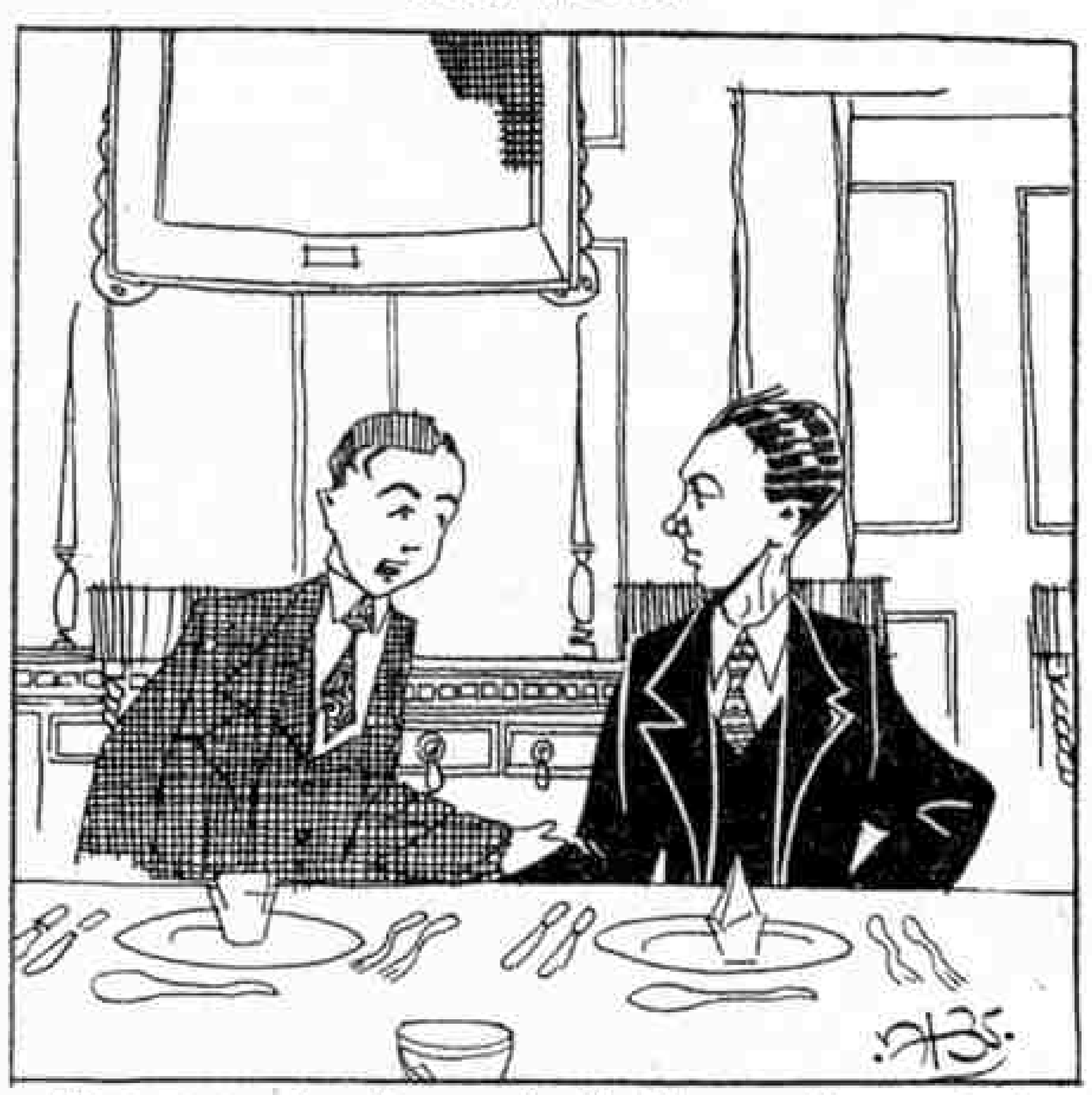
* * * *

"Were you pleased with the new school, little boy?" enquired an interested lady.

"No!" said Johnny. "They made me wash my face an' when I went home the dog bit me 'cause he didn't know me."

* * * *

HIS IDEA



Two garage hands were invited to a rather exclusive tea party. When they sat down they noticed that there were two knives and forks beside each plate. Bill leaned across to Harry:

"I say, Harry, what's the idea of two knives and forks?"

"Don't show yer ignorance, Bill. Them's the spares in case one of the others conks out."

A FAIR WARNING

Surveyor: "Yes, sir; the railway will run right through your barn."

Farmer: "Well, just make sure of this. I aint going to open and shut the door for every train for anybody."

* * * *

Customer: "Hi! You're giving me too much bone with that beef."

Butcher: "I'm not giving it. You're paying for it!"

* * * *

A lady was visiting the aquarium. "Can you tell me whether I could get a live shark here?" she asked an attendant.

"A live shark? Why do you want that?"

"A neighbour's cat has been eating my goldfish, and I want to teach him a lesson."

* * * *

Sergeant Murphy (to recruits): "That line is as crooked as a dog's hind leg. Fall out all of you, and have a look at it!"

* * * *

SPEAKING IN CONFIDENCE

Nearsighted Old Lady: "My good man, is this boat going up or down?"

Sailor: "Well, ma'am, she's a leaky old tub and she might go down; and then again, her boilers ain't none too good, and she might go up."

* * * *

A Naval officer was showing a young girl over the ship.

"Awfully interesting," she said, "But tell me, do you close the portholes when the tide rises?"

* * * *

Judge: "Now what passed between you and Flannigan?"

Murphy: "Two pairs of fists, one bottle, one hammer and ten bricks."

* * * *

Guest: "Waiter, are you responsible for this table?"
Waiter: "Yes, sir."
Guest: "This egg is bad."
Waiter: "Sorry sir. I laid the table, not the egg."

* * * *

"Is that big piece of cake for Tom, Mother?"
"No, that's for you."
"What a tiny piece!"

* * * *

The eminent financier was talking of his early career. "Yes," he said, "I started my business life in London with only a shilling in my pocket."

"May I ask how you invested that, sir?" ventured a keen young listener.

"Yes, my boy," was the reply. "I used it to telegraph home for more money."

* * * *

"Shall I pack this attaché case sir?" asked the salesman.

"Oh, no; don't trouble, thanks," the customer replied, "just put the string and paper inside."

* * * *

"What was the difference between Noah's Ark and Joan of Arc?"

"Noah's Ark was made of wood and Joan of Arc was Maid of Orleans."

AWKWARD FOR TOMMY

"Thank you very much, Tommy," said the Vicar, as the small boy handed in his harvest festival offering. "I must try and come round this afternoon and thank your mother for these eight nice apples."

"Please, sir," stammered Tommy, "would you mind thanking her for twelve?"

* * * *

"My wife runs her new machine splendidly; never goes so fast that she can't stop at once."

"What make is the car?"

"Car? It's a sewing machine."

* * * *

"Say, Rastus, you know what you're doin'? You is goin' away fo' a week and they ain't a stick of wood cut fo' de house."

"Well, what you all whinin' about, woman? I ain't takin' de axe wid me, am I?"

* * * *

Circus Boss (to new assistant): "Now look here, if the leopard escapes you must shoot him on the spot."

Assistant: "Yes, sir. But which spot?"

* * * *

For the third day in succession a dentist's maid reported that there was a man in the waiting room who refused to see the dentist.

"Perhaps he's nervous," said the dentist. "I'll go and see him myself."

He entered the waiting room and asked the man his trouble.

"Well, ye see," replied the visitor, "I just drop in because I'm reading a serial in one of your papers."

* * * *

Mr. Peck: "Only bread for dinner?"

Mrs. Peck: "Yes, dear, the turkey caught fire when I was putting on the pudding, and I had to put it out with the soup."

* * * *

Jim: "So you are entirely your own boss in your new job?"

Tom: "Quite. I arrive any time I want before nine and leave any time I like after five."

* * * *

Teacher: "Now, John, can you tell me what lbs. stands for?"

John: "Elbows!"

* * * *

A tired traveller was compelled to spend the night in a village inn. At breakfast he said to the proprietor: "I wish I had come to this inn when I passed this way six weeks ago."

"Oh," said the proprietor, "I am glad to hear that."

"Yes," continued the traveller, pushing his plate from him, "That egg would have been a lot fresher then."

* * * *

Teacher: "Please tell me why Tommy was absent from school yesterday, Mrs. Muggs."

Mrs. Muggs: "Well, it's his head, sir; he's had it off and on ever since he was born."

* * * *

TWO POINTS OF VIEW

Two country yokels were watching an airman doing "stunts."

"Well, Jarge," said one, "oi wouldn't loike to be up theer with 'un."

"And I woudn't loike to be up theer without 'un," replied the other.

INDEX

Vol. XX

Jan.—Dec., 1935

Aero Engines:—G.A.L. "V/4," 278; Remtor "Meteor," 80; "Bristol," 574, 708; Wolseley Radial, 11, 396
Aero Engine Testing, 574
Aeroplanes and Flying Boats:—Airspeed "Courier," Building, 148; Airspeed "Envoy," 12; Avro "642" and "652" Monoplanes, 340; Blackburn "Perth," 280; Blackburn "Shark," 456; Breguet-Wibault "670," 516; Dornier "Do.Y," 147; Douglas D.C.2, 576; Fairey "Swordfish," 576; Farman F-360, 81; Fokker F.XXII, 518; French and Dutch Civil and Military Machines, 150; Handley Page "47," 576; Imperial Airways New Liners, 214; Klemm "Eagle," 12; Miles "Hawk," 82; Miles "Hawk Major," 83; Miles "Nighthawk," 706; "Northrop 2E," American, 278; "Queen Bee," Pilotless, 575; Saro "London," 397; Short R.24/31, 455; Short "Sarafand," 633; Short "Scion" Improvements, 278; Short "Singapore III," 280
African Forest, Famous Explorer in, 86, 164, 228, 294, 354
Air News, 10, 80, 146, 212, 278, 338, 396, 454, 516, 574, 632, 706
Alchemist, Romantic Dreams of the, 364

Baboons in the African Hills, 388
Books to Read, 22, 96, 168, 234, 300, 362, 477, 534, 590, 656, 730
Bridges:—Belah Viaduct, Westmorland, 99; Golden Gate, San Francisco, 693; Little Belt, Denmark, 568; Middlesbrough, Vertical Lift, 1, 206; Railway, 726; San Francisco-Oakland, 514; Zahow, China, 332

Canals:—Aire and Calder, Yorkshire, 700; London-Newcastle, proposed, 568; Nicaragua, proposed, 204; Princess Juliana, Holland, 629; Russian, proposed, 695; Suez, 696
Caves, Yorkshire, 712
Cement Making, Processes in, 395
Chemical Magic at Home, 38, 170, 238, 302
Competition Pages, 58, 125, 195, 260, 323, 381, 427, 498, 558, 624, 669, 761
Competitions, Hornby Railway Company, 56, 126, 192, 258, 322, 380, 434, 494, 552, 616, 676, 754
Conjuring Tricks for Christmas, 702
Copper, Story of, 580
Cranes at Work, Giant Creeper, 570

Dams:—Huge American, 569; Metur Cauvery, 1; Vaalbank, S. Africa, 332
Diving in Search of a Lost Anchor, 560
Dredgers, 2, 330
Dynasphere, Vehicle that Rolls Like a Ball, 98

Editor, With the:—Brains Unlimited, 561; British Engineering Feats in 1934, 1; Brunel and the G.W.R., 501; Century of Invention, 329; Colour on the Films, 441; Flat Earth Fallacy Again, 69; Gold-plated Propellers, 501; Hero Worship, 385; Historical Dates Worth Knowing, 133; Hooke, Robert, 441; King's "Jubilee," 265; Lighthouses of the Sky, 133; Noise Limit for Cars, 625; Passing of a Famous Photographer, 201; Perpetual Motion a Delusion, 69; "Safety First," 385; "Silver Jubilee" Express, 625; Speed Records, 651; Thames Barrage Schemes, 201; World's Oldest Egg, 329
Elektron Outfits, Fun With, 40, 172
Engineering News, 6, 72, 136, 204, 332, 448, 568, 628, 694
Excavator, Europe's Largest Shovel, 630

Felling a Look-out Tower, 474
Fireside Fun, 61, 127, 193, 259, xiii, xiii, 439, 499, 559, 623, 683, 763
Flints and their Origin, 408
Floating Docks, Various Types of, 4
Footplate Runs:—G.R. "Night Limited," New Zealand, 626; G.R. "West Coast Express," New Zealand, 720: G.W.R. "Cornish Riviera Express," 462; L.M.S.R. "The Granite City," 224; L.N.E.R. 1.20 p.m. "Scotsman," 286; L.N.E.R. "Aberdonian," 400; L.N.E.R. Leeds "Breakfast Flyer," 646; L.N.E.R. "Mikados," 586; L.N.E.R. North British "Atlantics," 346; L.N.E.R. "Queen of Scots," 524; Swiss Federal Railways, 698; S.R. "Night Goods," 16
From Our Readers, 28, 88, 162, 230, 298, 358, 416, 478, 532, 598, 660, 734

Gas-Producing Plant in Scotland, 285
Ghost Story: The Speed Boat Passenger, 733
Gloves, Leather, How Made, 142
Gold Rush Days, Renewing the, 461
Great Ports—Capetown, 688; Durban, 566; Halifax, 336; Quebec, 226; Saint John, 444; Vancouver, 84
G.S. Railway (Ireland):—Bulk Grain Wagons, 351; Features of General Interest, 642; New Rolling Stock, 644
G.W. Railway:—Centenary of, 501, 520; Installing a New Machine at Swindon Works of, 161; "Castle" class engines, 465; "Hall" class engines, 645; "Cornish Riviera Limited," 523

Hand Pottery, How Carried Out ,211
Heat as an Enemy of Speed, 736
Hornby Railway Company, Branch Notes, 55, 119, 187, 253, 317, 375, 435, 495, 553, 617, 677, 755
Hornby Railway, Special Articles:—"Bramham Moor," Miniature of L.N.E.R., 673; Hornby Accessories and Realism, 124; Hornby Wagon Tarpaulins, 491; Interesting Layout Features, 318; Layouts in the Garden, 377; New Bogie Coaches, 549; New Vans for Perishable Traffic, 612; Piloting and its Reproduction in Miniature, 376; Portable Exhibition Line, 672; Sidings and Reversing Loops, 120; Signals on Hornby Railways, 254; Simple Track Systems, 57; Station Layouts in Miniature, 188
How to Get More Fun, H.R.C. Articles:—Cuttings, Tunnels and Viaducts, 256; G.W.R. Traffic Working, 550; Headlamp Code in Hornby Railway Working, 614; Hornby Electric Railways, 52; Hornby "North-Eastern" Services, 320; Improving the Appearances of a Layout, 378; L.M.S.R. "West of England" Services, 122; Locomotive Depots on Hornby Railway, 190; Preparing for Winter Activities, 674; Road-rail services on Hornby Railways, 492; S.R. (Eastern Section) Services, 432; The Miniature Railway Hobby, 750
Hydraulic Press, Giant Russian, 631
Hydro-Electric Plants:—Beauharnois, Power Development at, 137; Niagara, Giant Valves at, 284; Sillre, Sweden, 74

Ice Factory, Great Britain's Largest, 270

Lighthouses along the Californian Coast, 710
Lightning Conductor 1,000 Miles Long, 578
L.M.S. Railway:—More "Princess" class engines, 464, 465, 522; New Breakdown Cranes, 352; New Insulated Milk Vans, 526
L.N.E. Railway: "Pacific's" 108 m.p.h., 221; Speed Records on, 37; Welded Wagons, 467
Locomotives:—British in the Great War, 20; Building the "Princesses" at Crewe, 716; Bury's type of former days, 406; Development of Fire-box in, 158; Early Continental Types, 722; G.E.R., Old, "Mixed Traffic" class, 407; G.W.R. "King Henry VII," 289; L.M.S.R. "Midland Compounds," 582; L.M.S.R. New 2–6–2 Tank, 291; L.M.S.R. Progress in the Highlands, 648; L.M.S.R. "Turbomotive," No. 6202, 466; Optical Lining-up of, 95; Origin of Locomotive Whistles, 560; Shipping of Giant, 134

Machine Tools, Interesting New, 509
Madame Tussaud's, Romance of, 562
Maori War Canoe, Building a, 32
Margarine Factory Equipment, 419
Maya, Great "White Ways" of the, 26
Meccano Aero Engines, 740
Meccano Aids Cinema Advertising, 304, 541
Meccano Aids Inventor of Launching Device, 49
Meccano Club Notes, 51, 117, 185, 251, 315, 373, 429, 488, 546, 610, 670 748
Meccano Competition Models:—Barendrecht Lift Bridge, 113; Biplane, 54; Buckingham Palace, 667; C.N.R. Locomotive, 545; Coach and Pair, 544; Coasting Steamer, 371; Churches, Houses, Castles, etc., 109, 248; Dutch Street Locomotive, 313; Engineering Workshop, 43; Fretwork Machine, 487; Gas Fire, 182; Heavy Traction Engine, 112; H.M.S. "Nelson," 421; Horizontal Steam Engine, 182; Internal Combustion Engine, 183; Jazz Band, 746; Lawn Mower, 747; Liner, 112; Lister Commercial Truck, 311; "Locomotion No. 1," 312; Low wing Monoplane, 54; Paddle-steamer, 183; Picture, 108, 609; "Queen Mary," 425; Record-changing Gramophone, 107; Runcorn Transporter Bridge, 249; Scammell Mechanical Horse, 422; Sea-drome, 666; Sports Car, 48, 54, 310, 371; Threshing Machine, 313; Tractor, 54, 609
Meccano Dinky Toys, Fun with, 652
Meccano Dobby Looms, Weaving with, 44
Meccano Fire Engine with Real Pumps, 737
Meccano Guild, Secretary's Notes, 50, 116, 184, 250, 314, 372, 428, 489, 547, 611, 671, 749
Meccano Model-Building Contest Results, 54, 112, 183, 249, 313, 371, 425, 487, 545, 609, 667, 747
Meccano Models, New:—Arch Bridge, 306; Automatic Truck Tipper, 366; Bascule Bridge, 243, 366; Car-lifting Apparatus, 306, 423; Cierva "Autogiro," 180; Cinematograph, 176; Continental Church, 109; Crane, 366; Couch, 180; Derrick Crane, 307; Destroyer, 306; Drop Hammer, 242; Dynamometer, 307; Easy Chair, 115; Electric Clock, 662; Electric Clock Mechanism, 240; Funicular Railway, 422; Gramophone, 114; Hand-operated Swing, 180; Hay Cart, 46; Heald-making Machine, 422; Locomotive, High-Pressure, 34, 104, 174; Loom, 440; Lumber Wagon and Horse, 94; Master Clock, 536; Mobile Crane, 743; Mortar Mixer, 243; Motor Breakdown Crane, 46, 742; Motor Cars, 542; Motor Vehicles, 664; Paddle Steamer, 181; Pontoon Crane, 423; Railway Breakdown Cranes, 743; Sailing Ships, 242, 606; Ship Coaler, 423; Spaniel, 114; Stamping Mill, 46; Steam Lorry, 115, 480; Stone Sawing Machine, 367; Swing Boat, 114; Swivelling Crane, 243; Telpher Span, 47, 243; Textile Machinery, 178; Trolley Bus, 420; Watchman's Hut, 47; Wire-Rope Maker, 423; Wringing Machine, 181
Meccano Models Operated by "Magic" Motor, 602
Meccano Models with Motor Car Parts, 483, 539
Meccano Motor Cars, Racing with, 308
Meccano Theodolite, Surveying with, 244
"Mickey Mouse" Films, How Made, 386
Model-Builders, With the, 43, 179, 310, 426, 540, 668
Model Life-Boat, an Interesting, 160
Model Locomotives, Construction of, in S. Africa, 353
Model "Queen Mary," Building a, 650
Model Railways, Interesting, 403, 404, 430, 490, 548, 613
Model "West Coast Postal" Train, 118
Money Box in Great Britain, Oldest, 145
Morris Car Assembly Plant, 138
Motor Boat, Mid-Channel Dash by, 634

Natural History, Animals:—The Grey Squirrel; 460. Birds:—Marvels of Nest Building, 208; Members of the Hawk Family, 274. Fishes:—Wonders of a Coral Sea Garden, 140. Plants:—Intelligence of, 266; Life of, in North American Desert, 30: Stinging Plants and Insects, 475

Of General Interest, 76, 216, 344, 472, 594
Optical Illusions, 728
Organ, Mechanism of a Giant, 600
Our Busy Inventors, 24, 166, 292, 410, 528

Papier Maché, Life-Like Models in, 452
Peat Bogs, Power from, 8
Photographer on Holiday, the Amateur, 450
Photography, Infra-Red, 596
Plano-Milling Machine, Giant, 686
Printing, Silk Screen Colour, 70
Puzzle Pages, 59, 705

"**Q**ueen Mary," Building a Model, 650

Railway News, 18, 92, 156, 222, 288, 350, 400, 464, 522, 584, 644, 718
Railway Photographs, Collecting, 152
Railways:—Facts about British, 468; "Flying Cologner," 585; "Flying Scotsman's" Record, 645; How Southern Stock Reaches the "Tube," 588; Silver Jubilee Exhibition, Euston, 348; "Silver Jubilee" Express, L.N.E.R., 660, 718; Special Trains for Passenger and Goods, 154; Streamlined Trains in United States, 218; "West Coast Postal," L.M.S.R., 589; World's Fastest Newspaper Train, G.W.R., 290
Refrigerating Machinery, Making, 458
Road and Track, 268, 390, 504
Road Roller, Story of, 506

Sea Trips: On the "St. Briac," 690; On the "Ulster Queen," 572
Sea-Water, Wealth Extracted from, 100
Ships:—"Bencas," Norway, 72; Dredger "Onger," 448; Fire Prevention in, 636; "Mauretania" Passes, 342; "Normandie," French Line, 392; "Ocean Coast," Coast Lines, 694; "Orion," Orient Line, 629; "Queen of the Channel," 565; "St. Briac," Trip on, 690; "Strathmore," P. & O., 629; "Talisman," L.N.E.R., 136, 569; Train Ferry on Lake Ontario, 415
S.R. Railway:—Coach Development, 719; More "Schools" class engines, 289; Train-Ferry Services, Cross Channel, 289
Stamp Articles:—African Stamp Stories, 261; Anatomy of a Stamp, 197; Catalogue Terms Explained, 129; Gossip, 65, 131, 199, 263, 327, 383, 437, 555, 681, 759; King's Collection, 325; Railway Museum in Stamps, 679; Remodelling the Collection, 63; Stamp Story of Canada, 497; Subject Collections, 757; What is Philately? 619
Steel, Development of Stainless, 714
Suggestions Section:—Ackermann Steering Gear, 739; Automatic Brake for Winding, 246; Bevel Reduction Gear, 739; Combination Lock, 369; Counting Machine, 246; Four-movement Gear-Box for Cranes, 368; Four-speed and Reverse Gear-Box, 484; Gear-Box for Cranes, 368; Gearless Reduction Drive, 247; Hacksaw, 111; Intermittent Motion, 369, 605; Laboratory Apparatus, 485; Miscellaneous, 247, 369, 605, 739; Oscillating Mechanism, 605; Pincer Grab, 111; Shaft Governor, 111; Silent Freewheel, 485; Simple Three-Speed and Reverse Gear-Box, 604; Small Roller Bearing Unit, 605; Speedometer, 485; Synchronous Electric Motor, 101; Three-Bladed Propeller, 247; Toggle Mechanism, 739; Traffic Clutch, 247; Two-Movement Gear-Box, 738; Unusual Digging Motion for Mechanical Excavator, 738; Voting Contest, 111, 485
Sundials and Mechanical Clocks, Early, 658

Table Top Photography, 78
Telescope, Giant Mirror for 200 in., 512
Tramway, An Old Cheshire, 418
Transporter, at Corby Steelworks, Electric Ore, 447
Tunnels:—Alps, proposed, 568; Liverpool, proposed, 448; Mersey, Cleaning the, 446; Scheldt, Antwerp, 202; Tyne, proposed, 332; Vosges, 568
Turntables:—Design of Locomotive, 90; Developments on L.N.E.R. and L.M.S.R., 349, 645

Valves, Giant, at Niagara Power Plant, 284

Water, Raising by Treadmill, 414
Water Supplies from Swiss Glaciers, 560
Waterwheels of Hama, 502
Welding for Bridge Repairs, Arc, 334
Well-Sinking in the North Downs, 236, 277, 360
Wind-Tunnel, Chalais-Meudon, 398
World Fair at Brussels, 272

X-ray Tubes, Giant, for Heating Purposes, 102

Yosemite National Park, 510

Zululand, Natives of, 442

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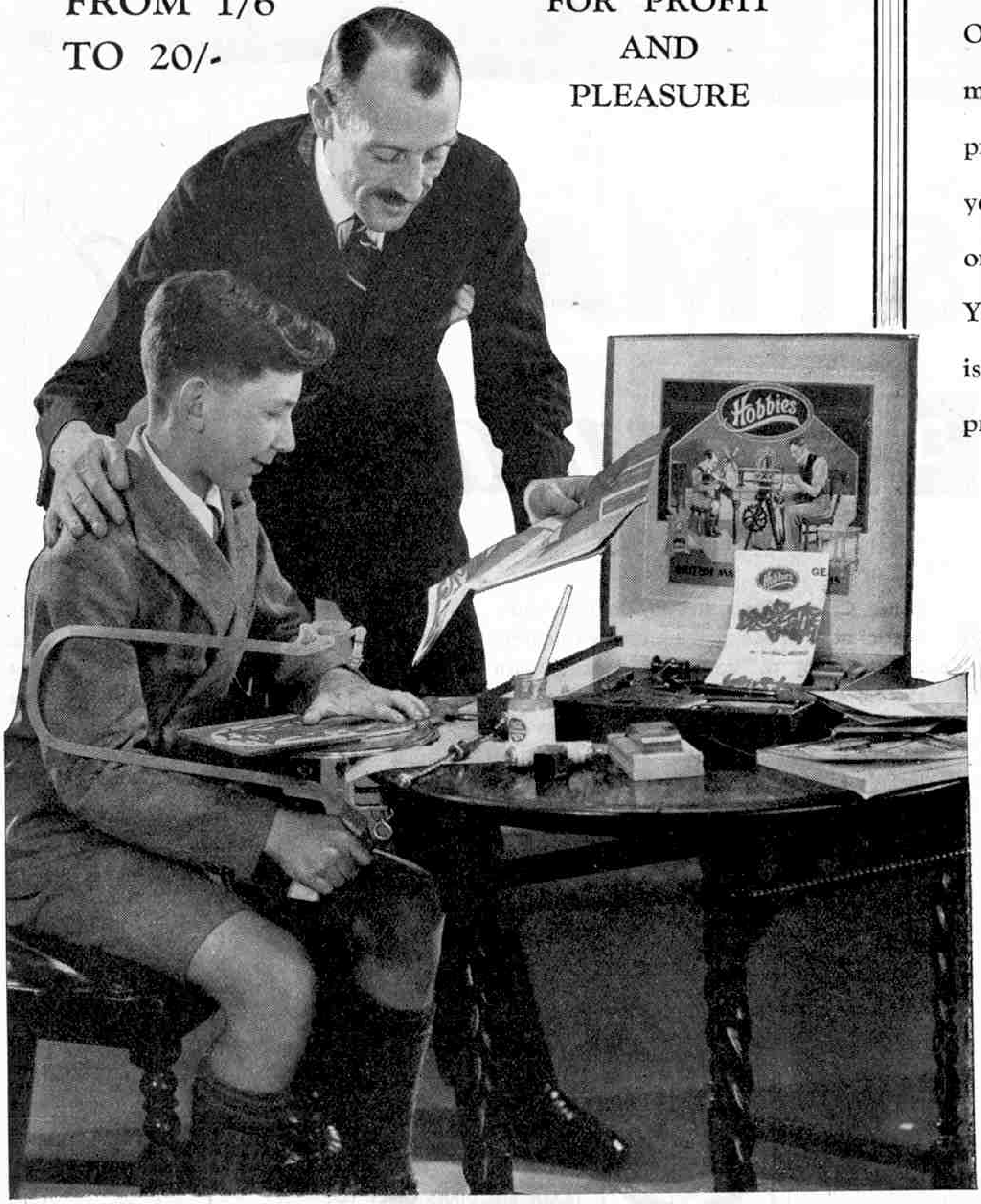

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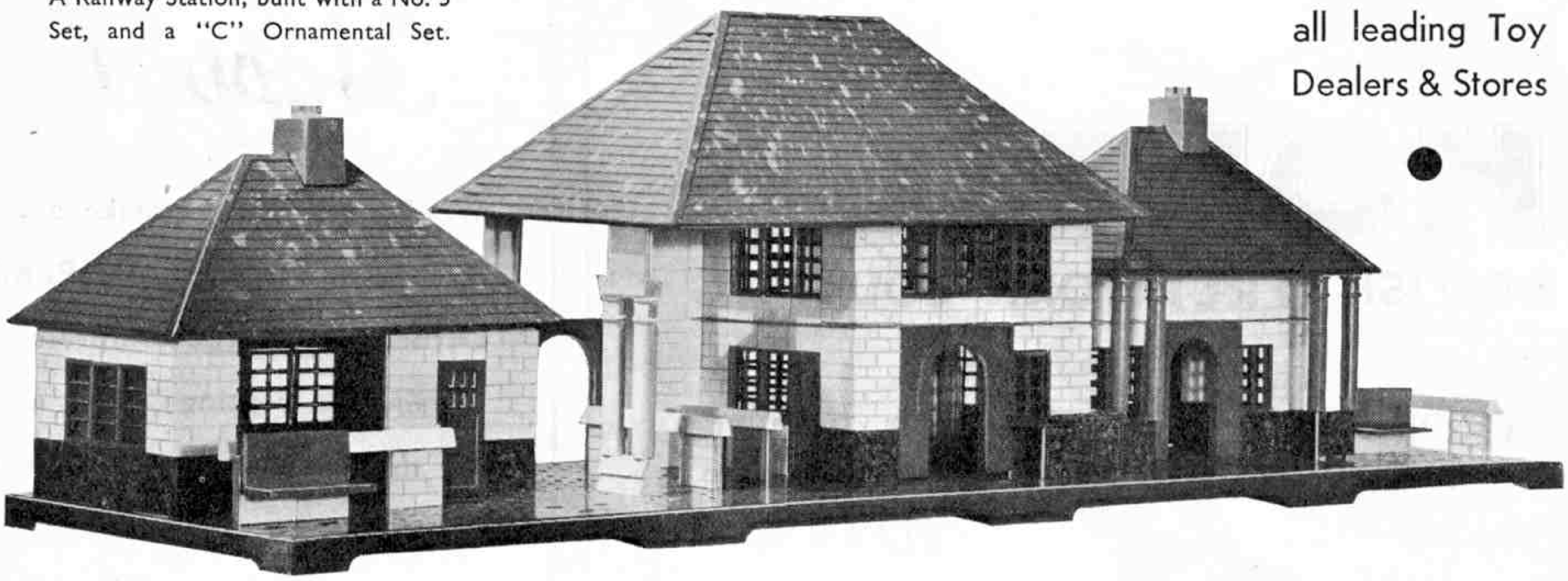

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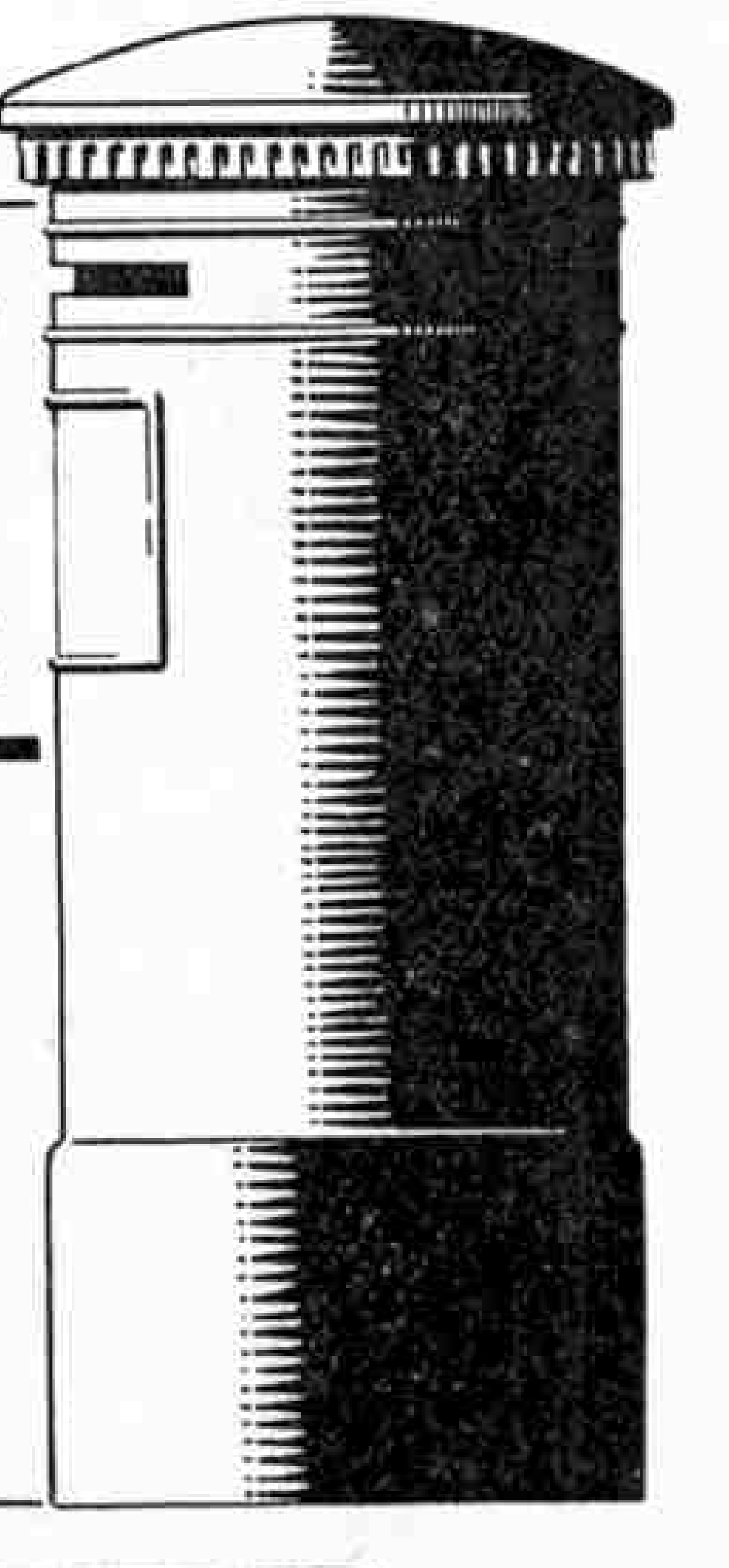

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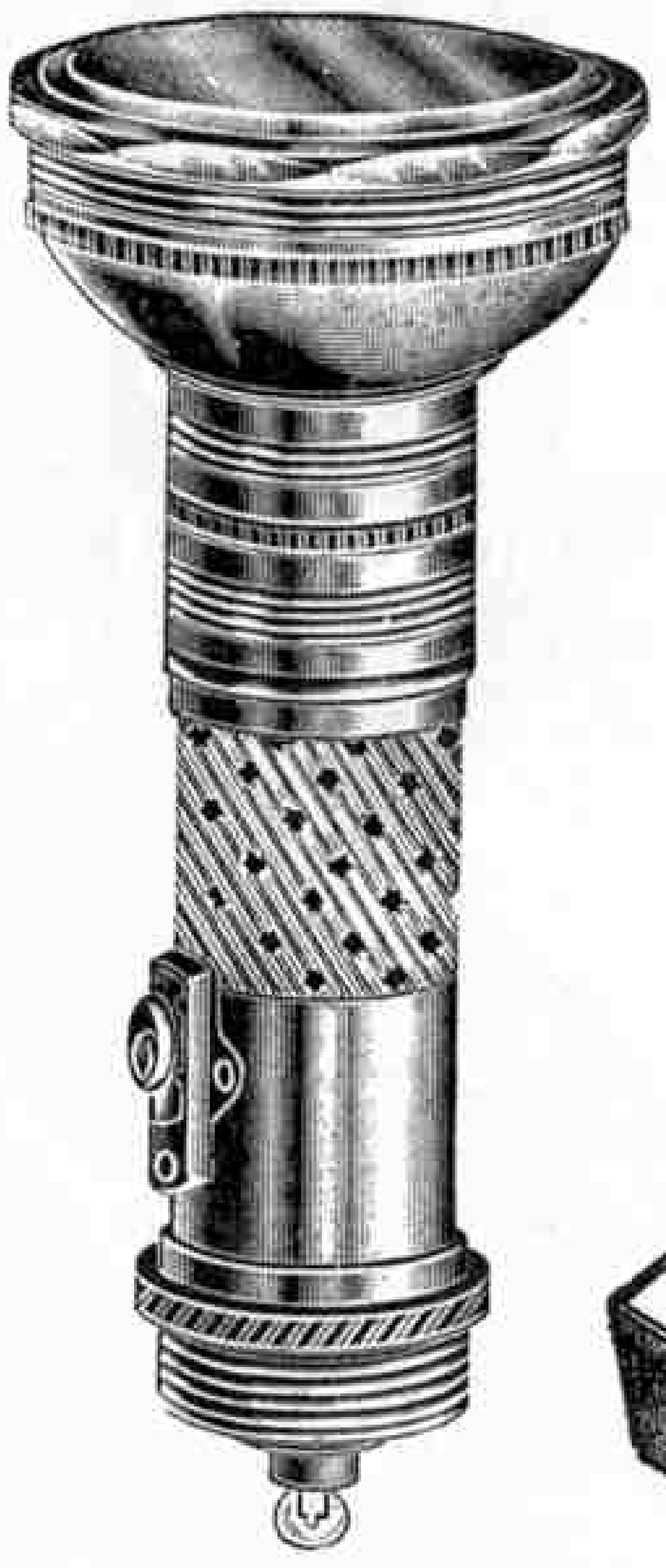

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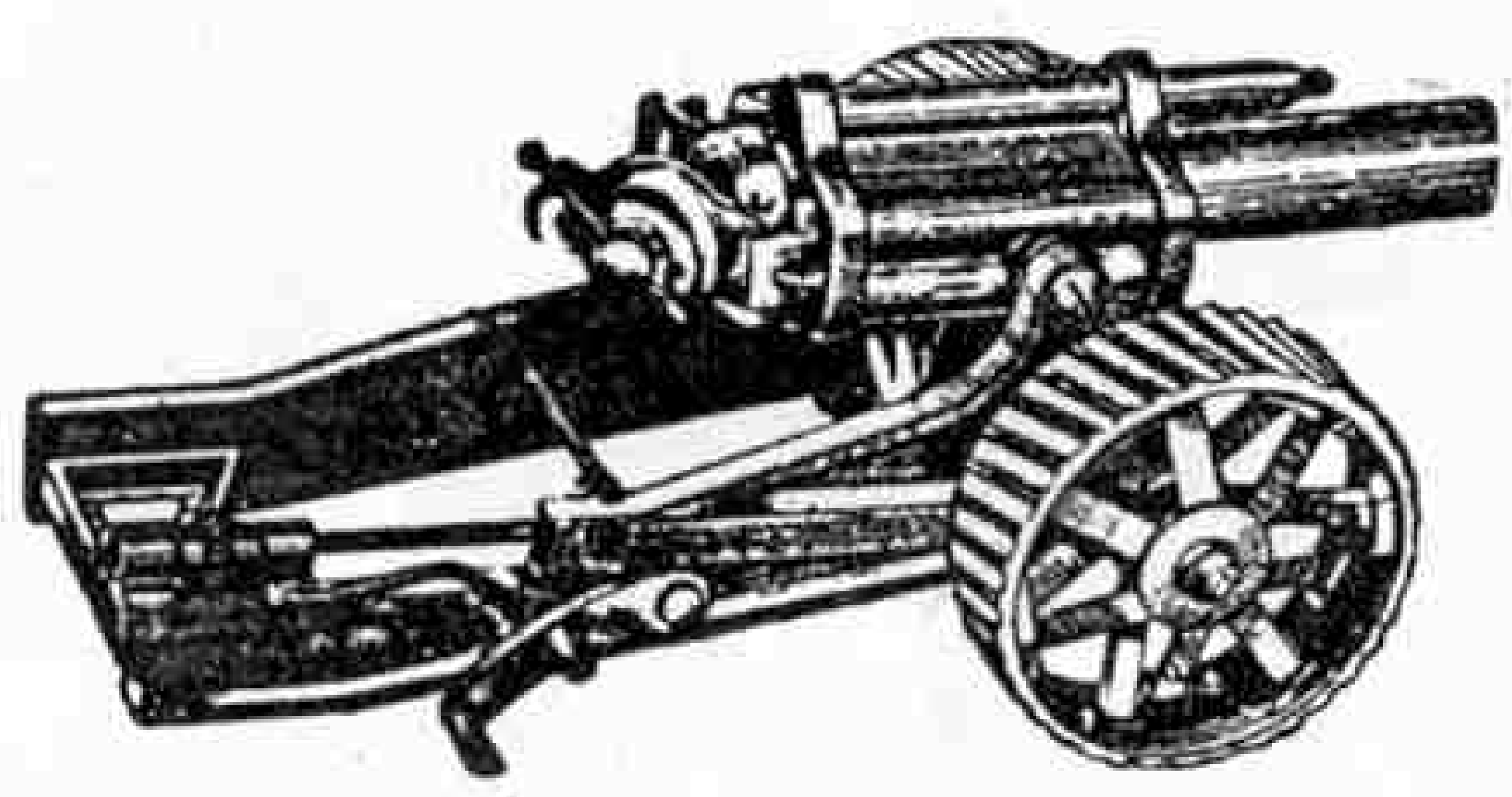

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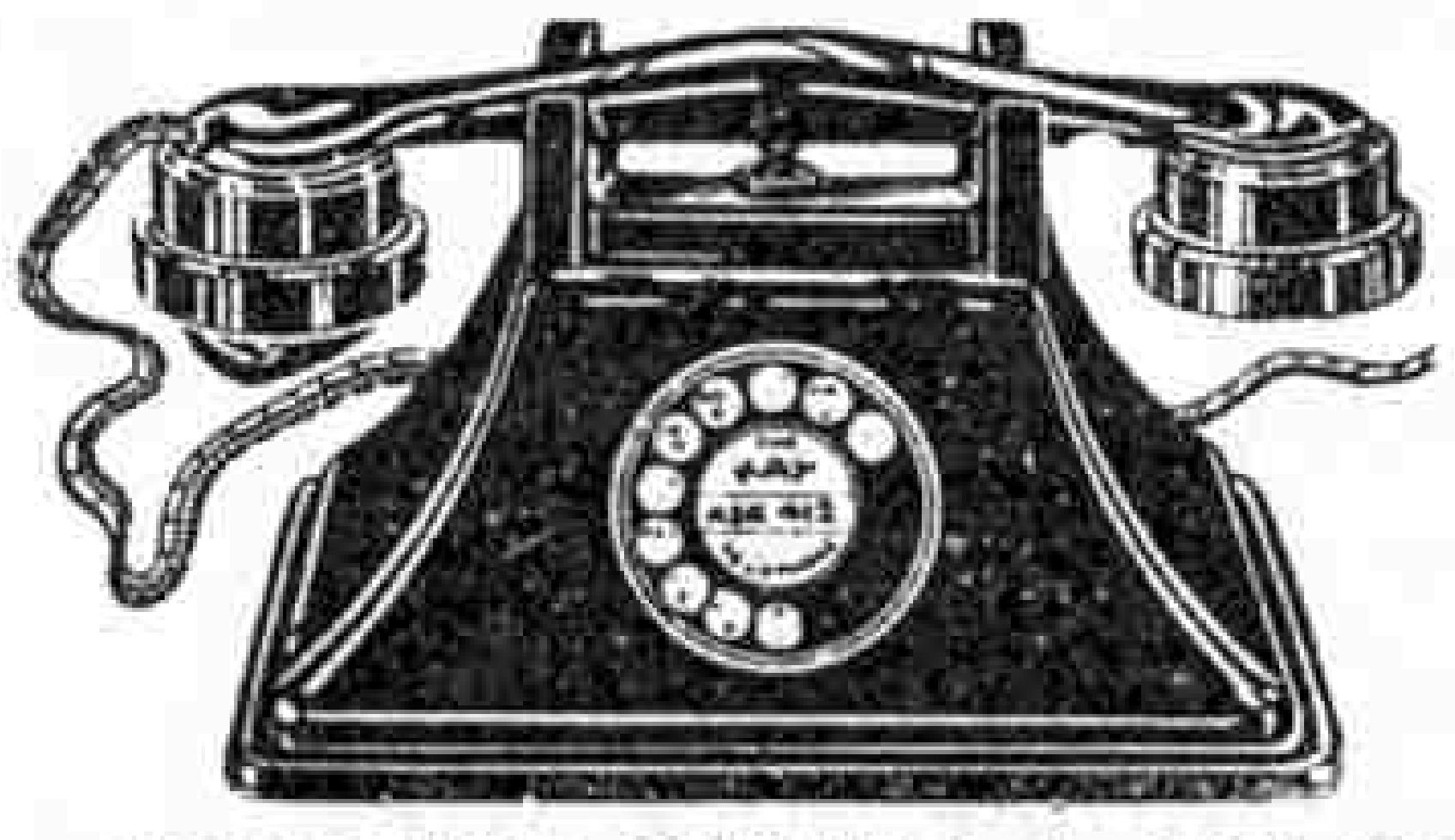

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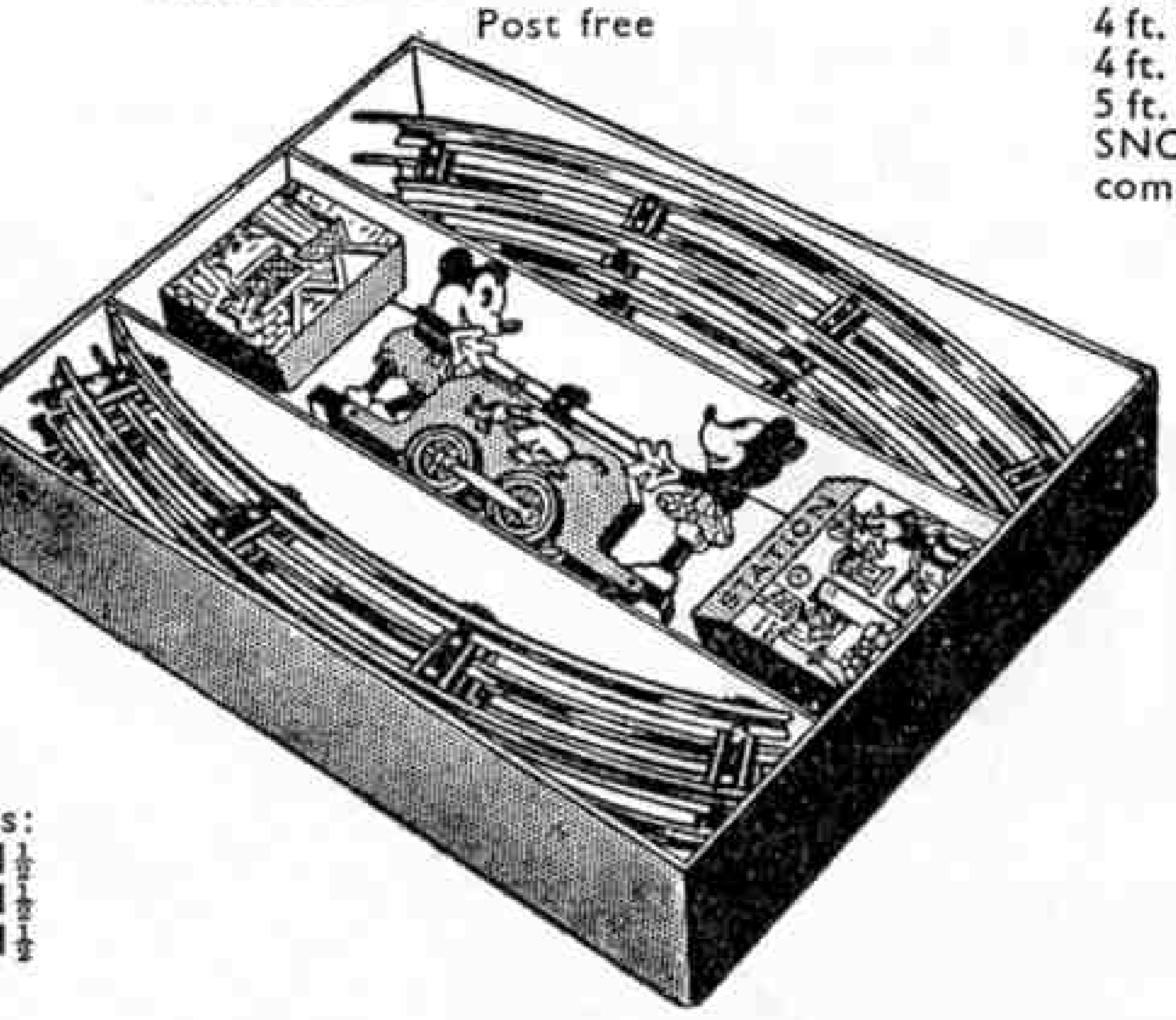

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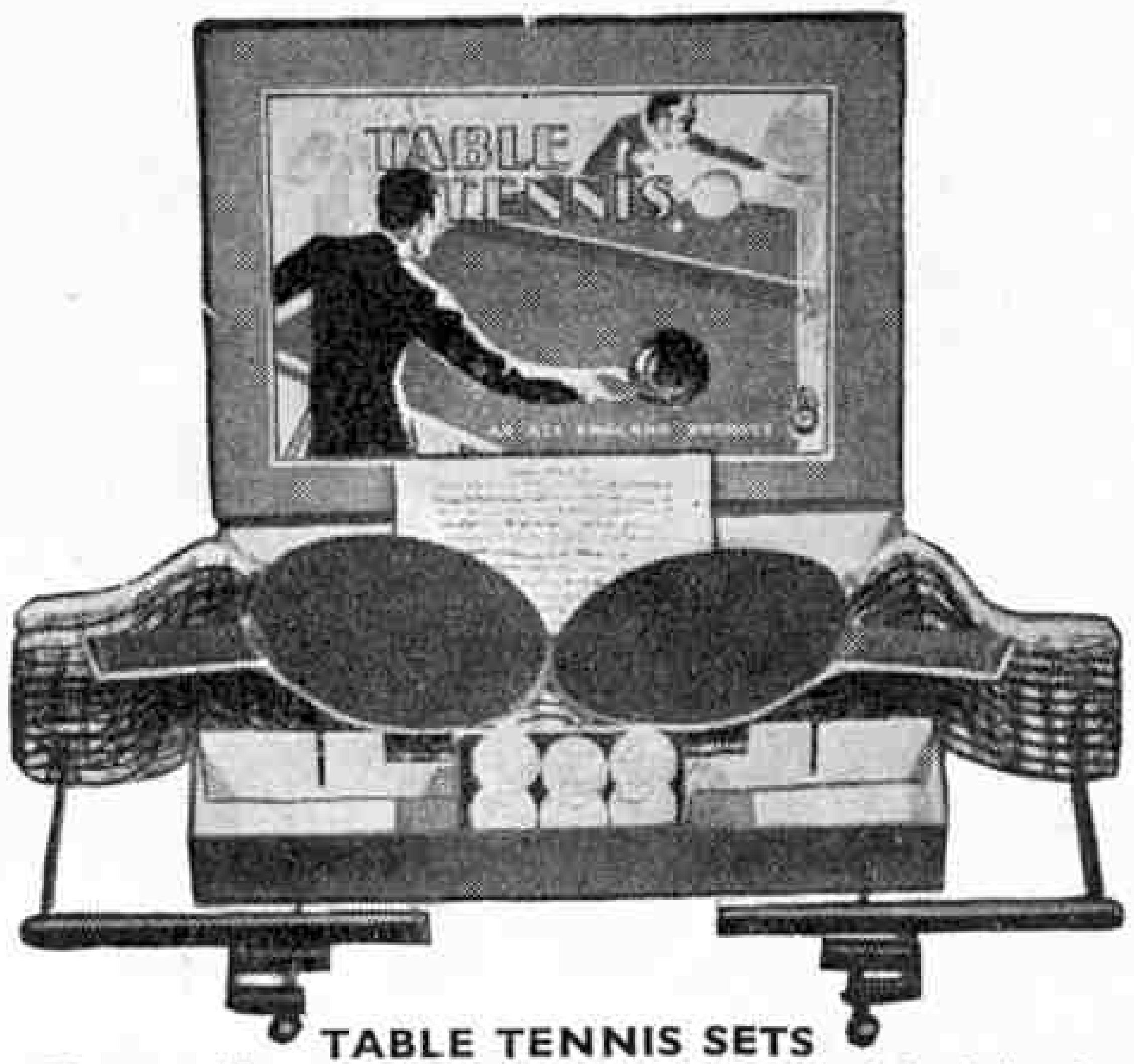

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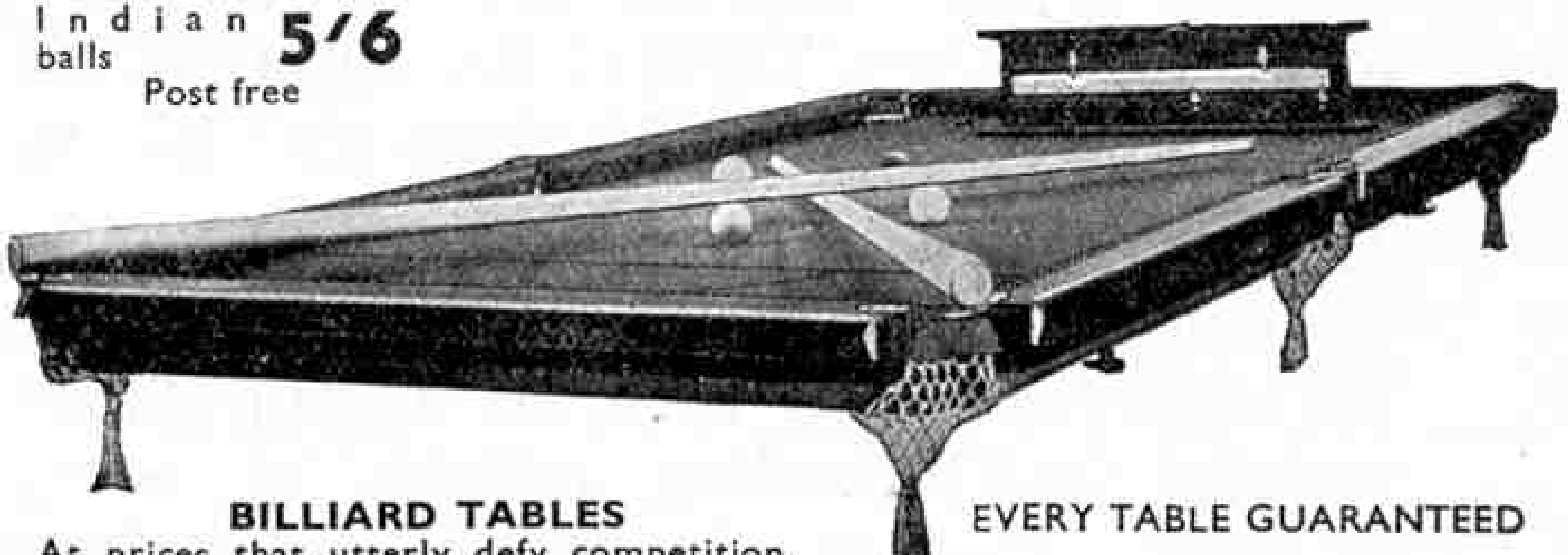

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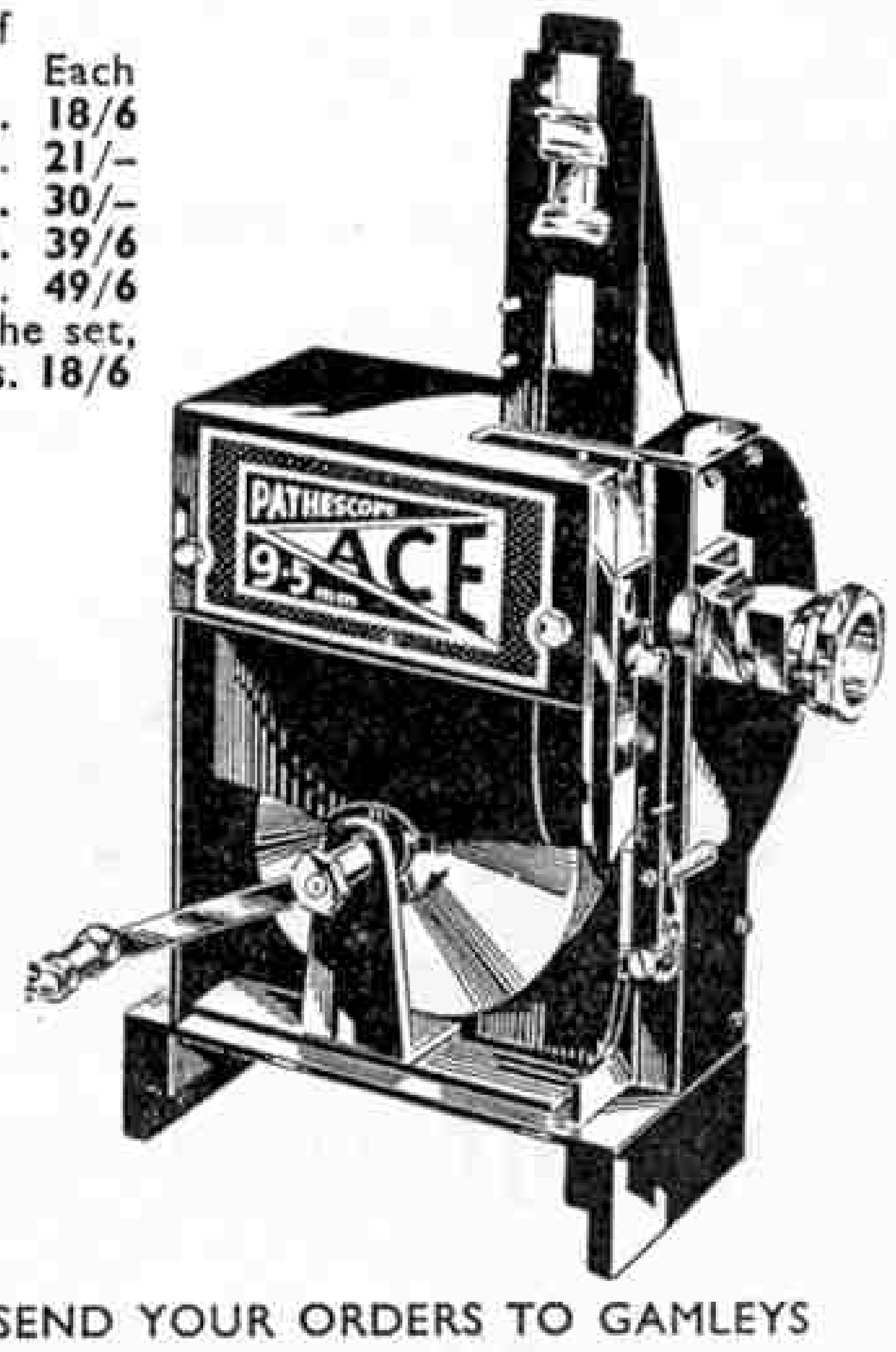

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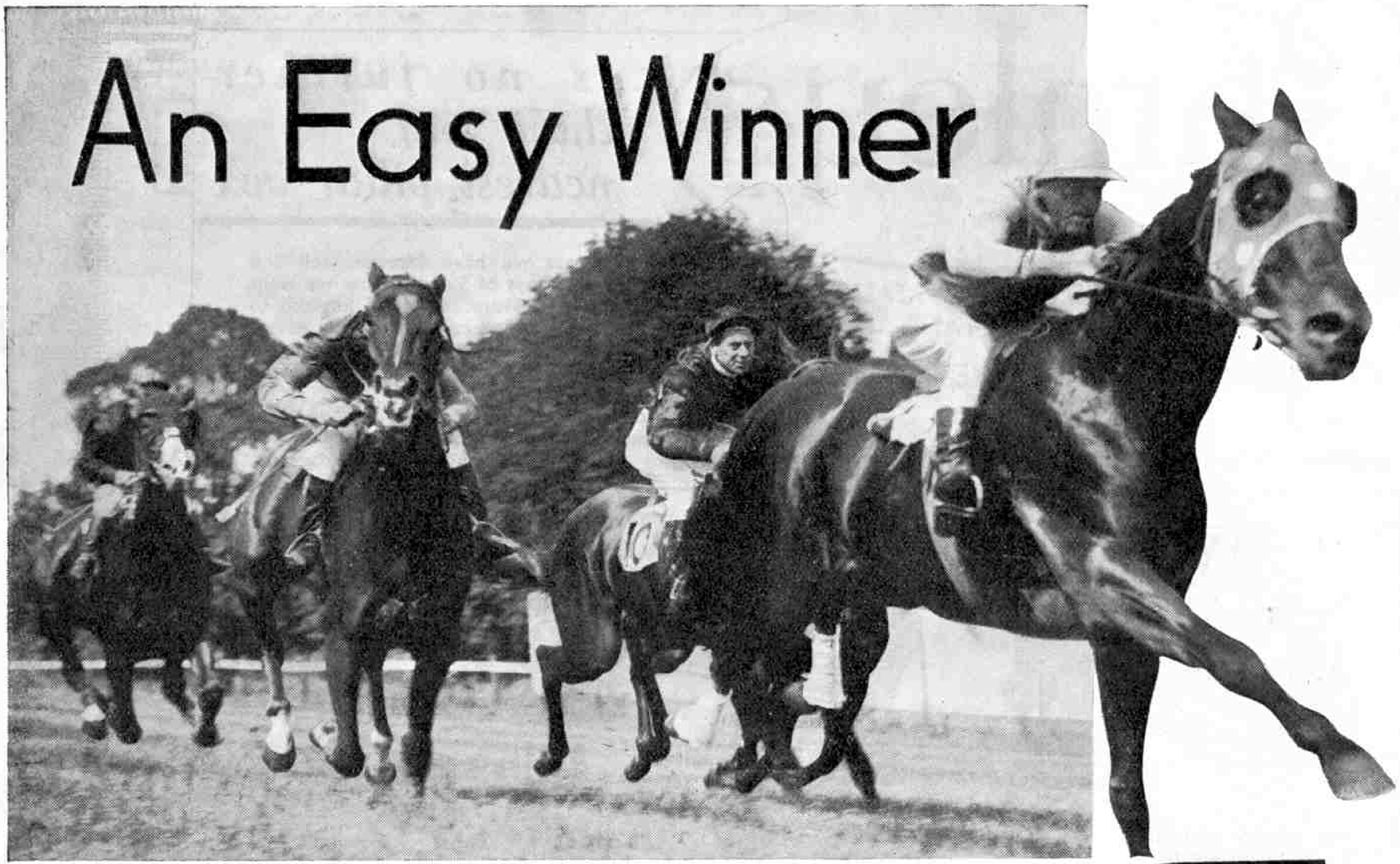

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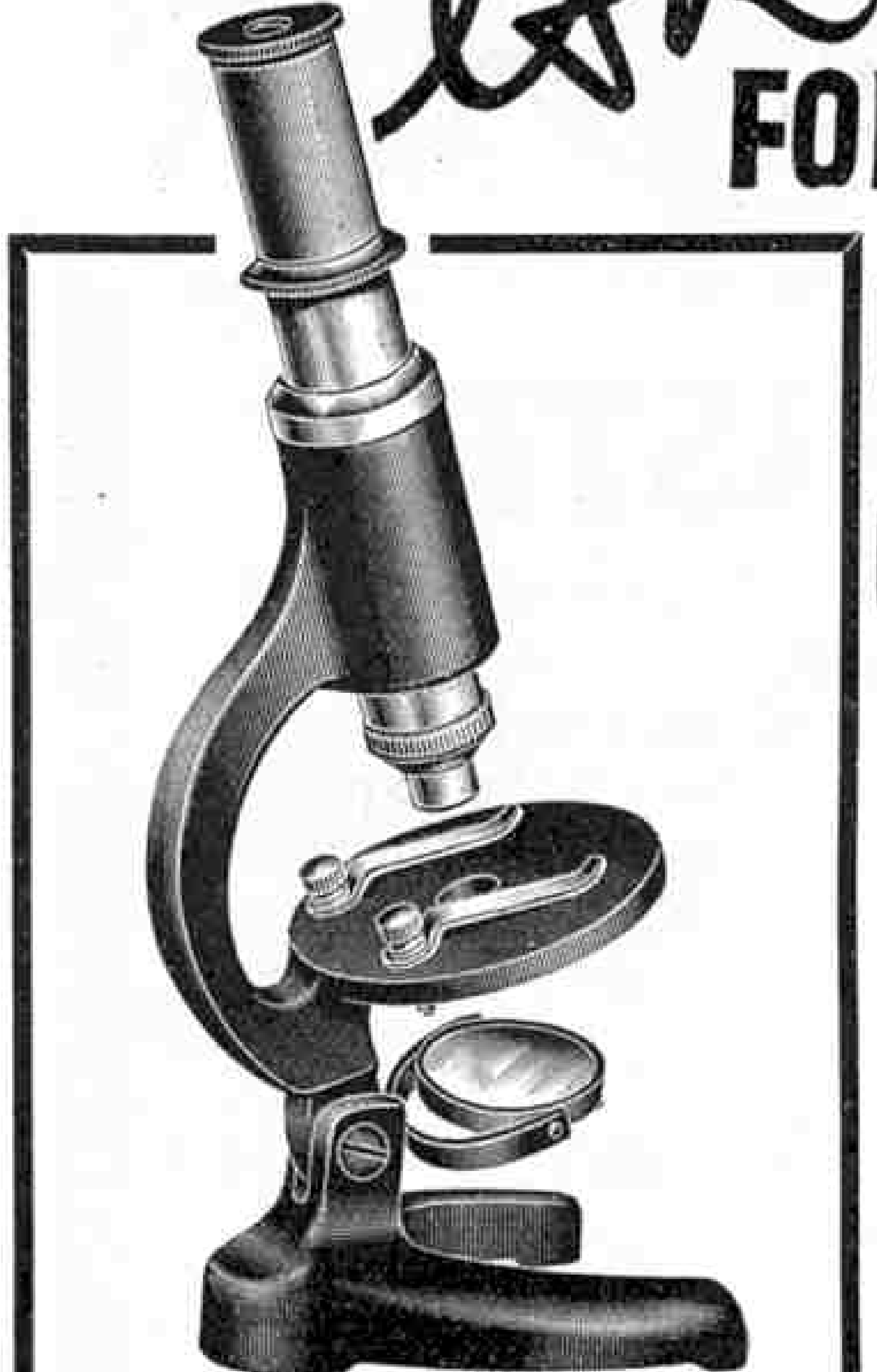

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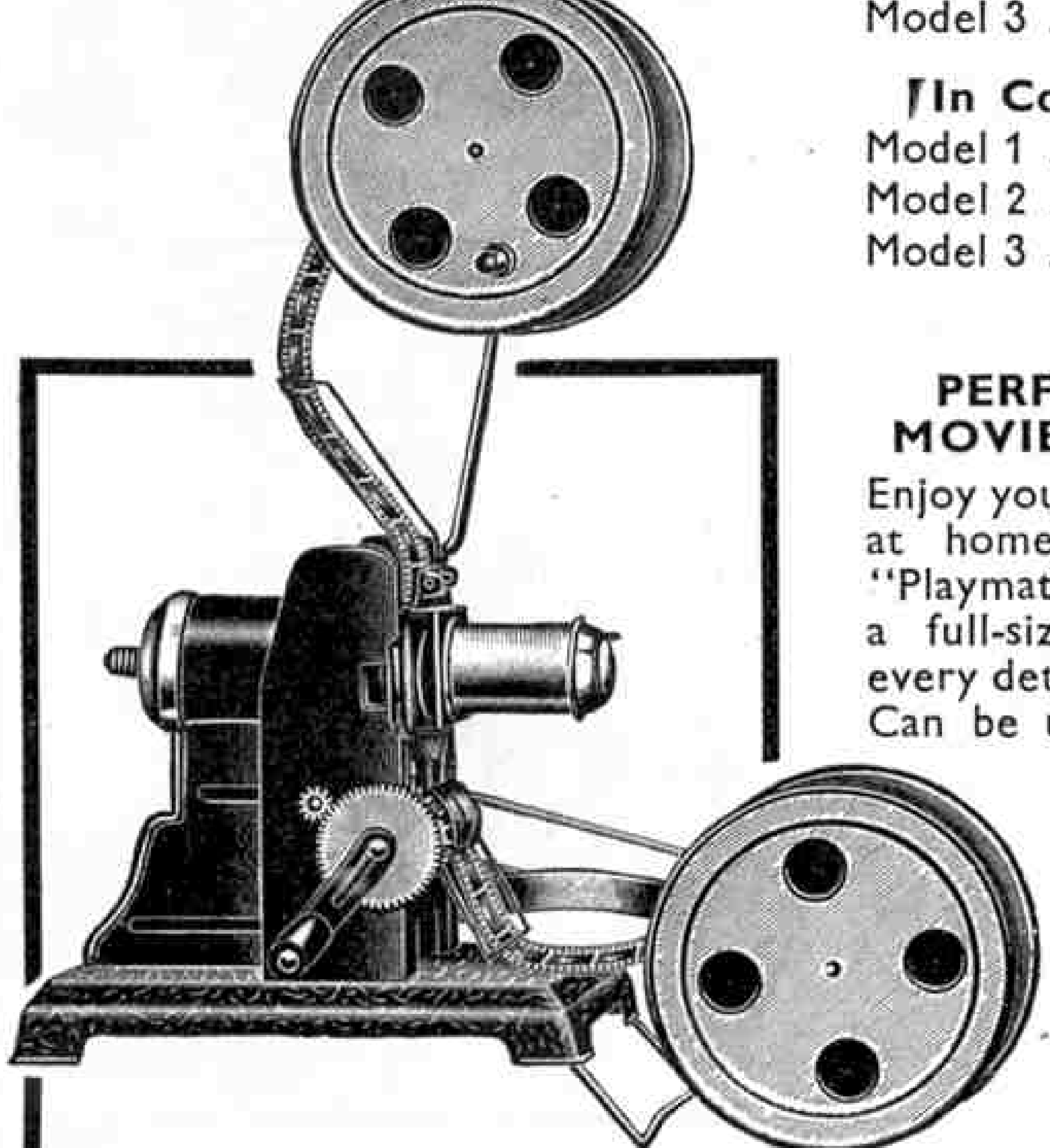

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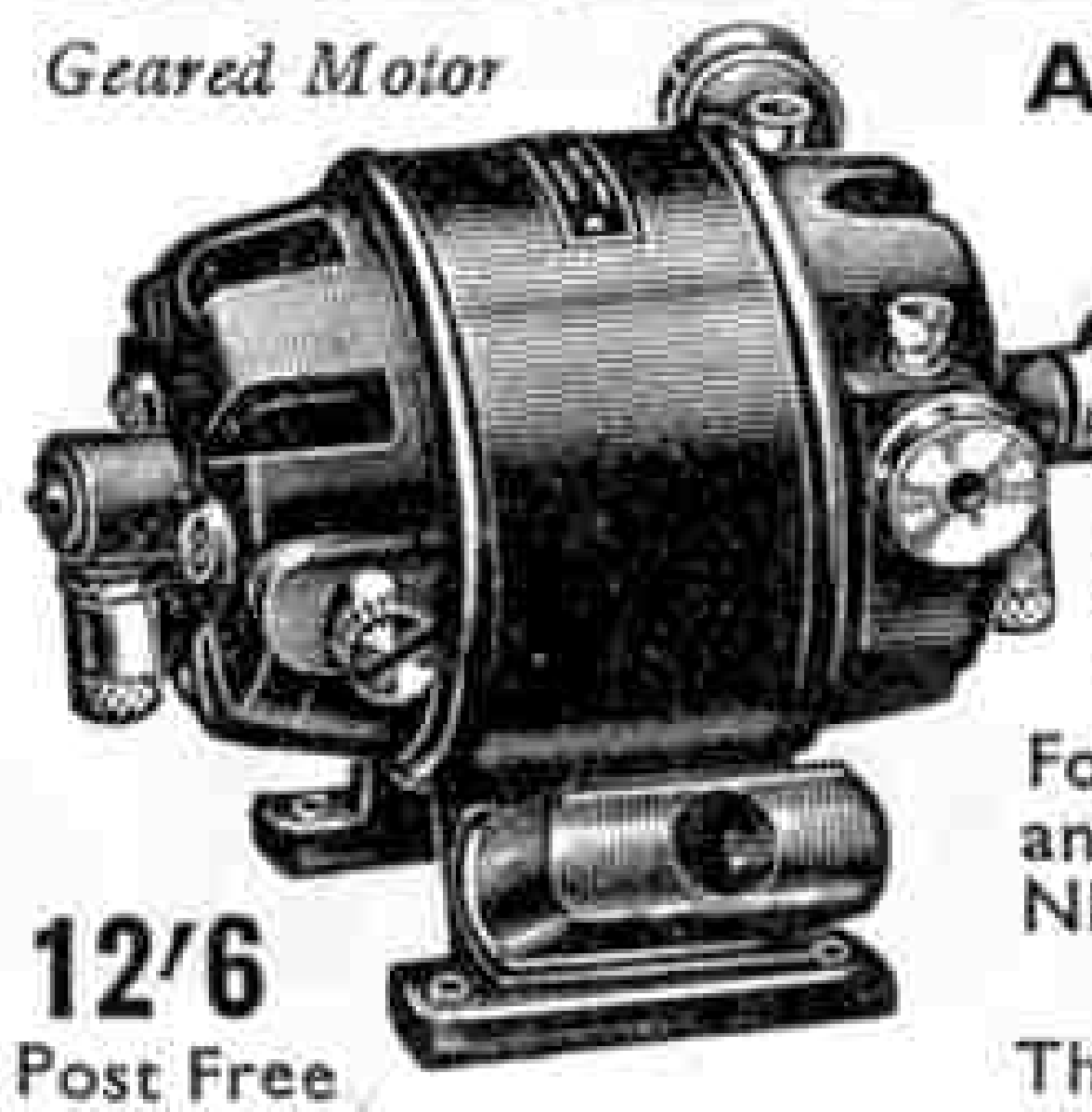

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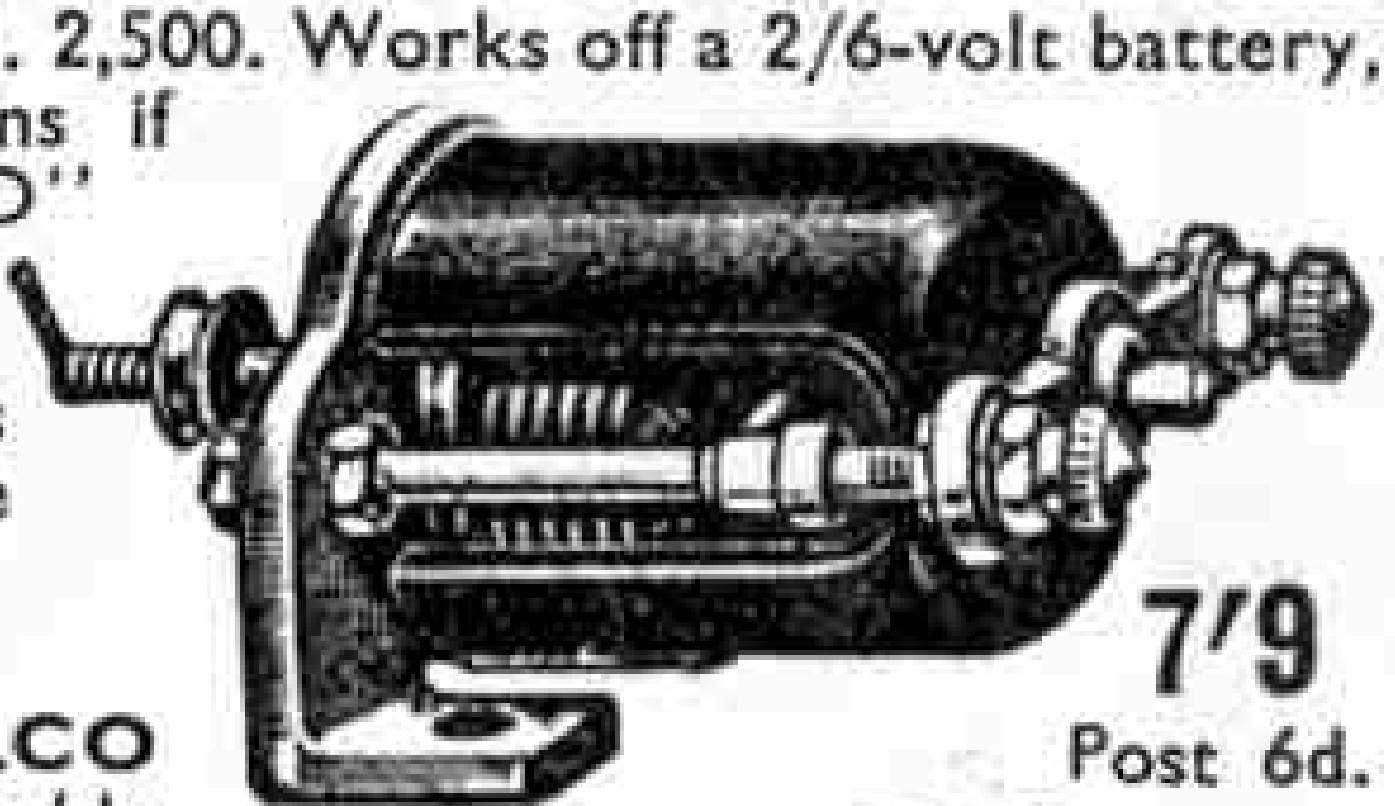

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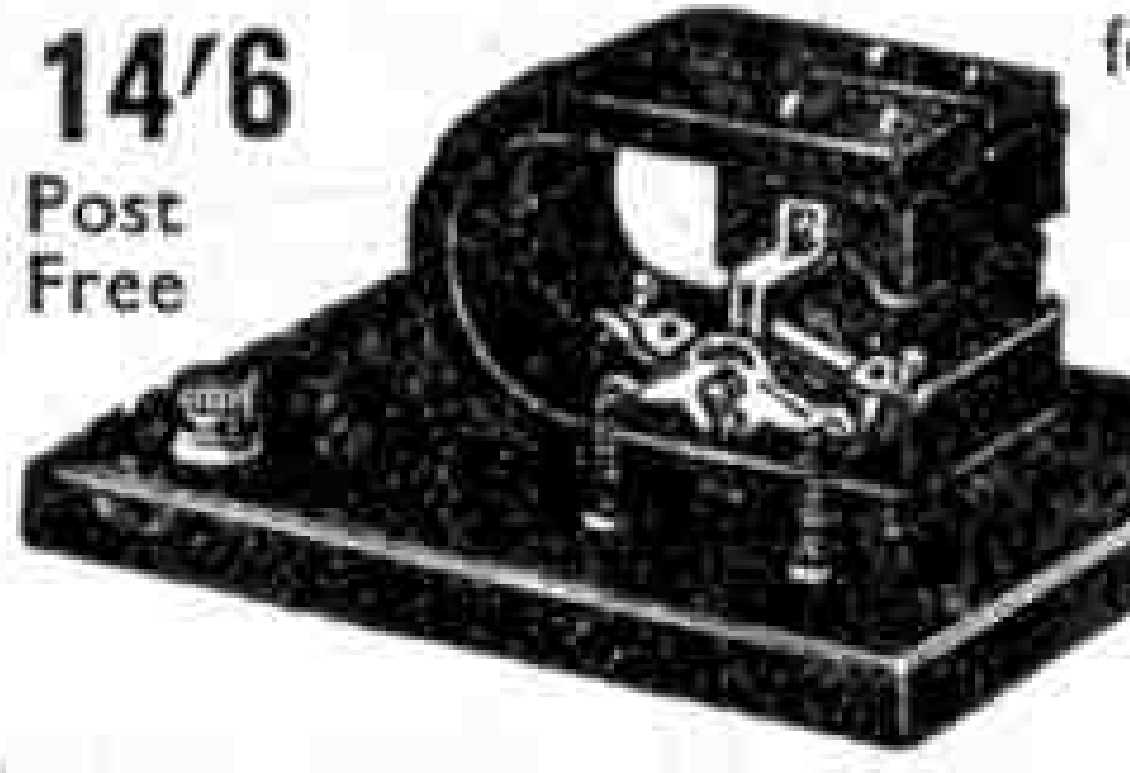

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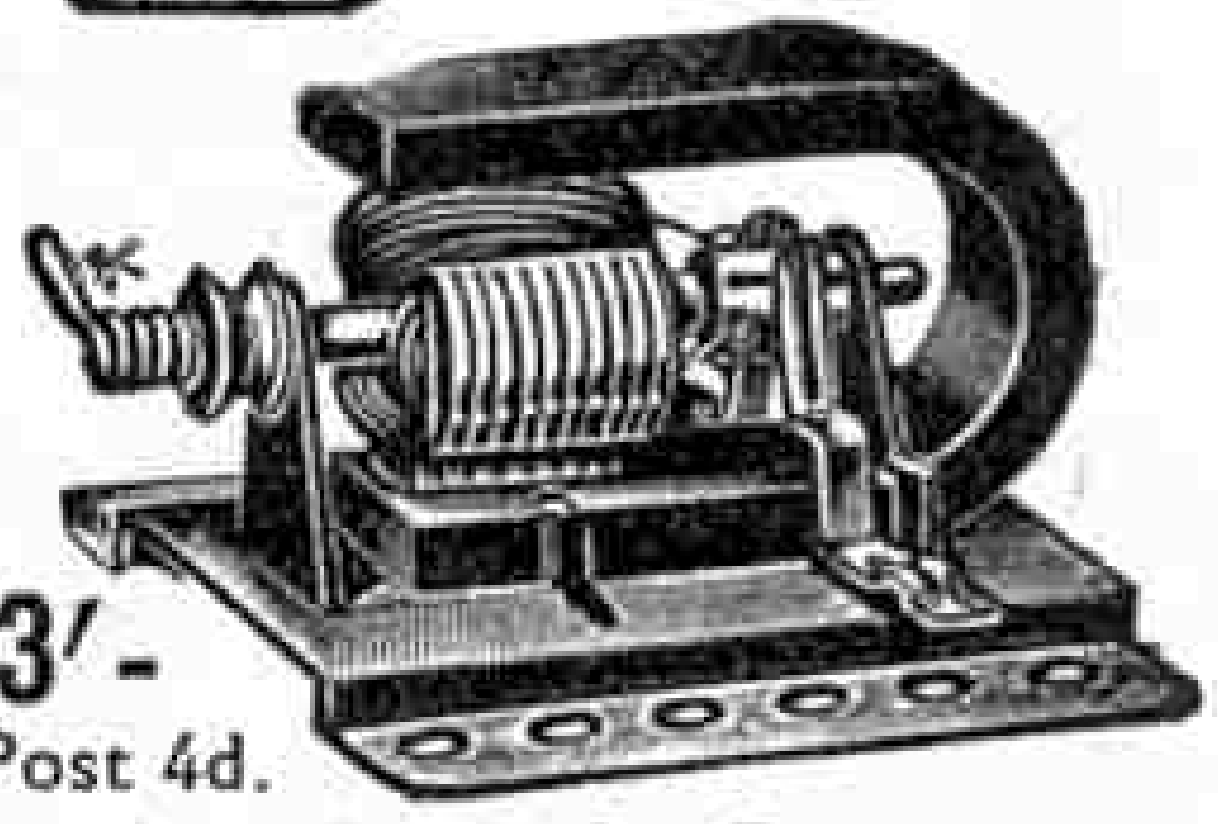

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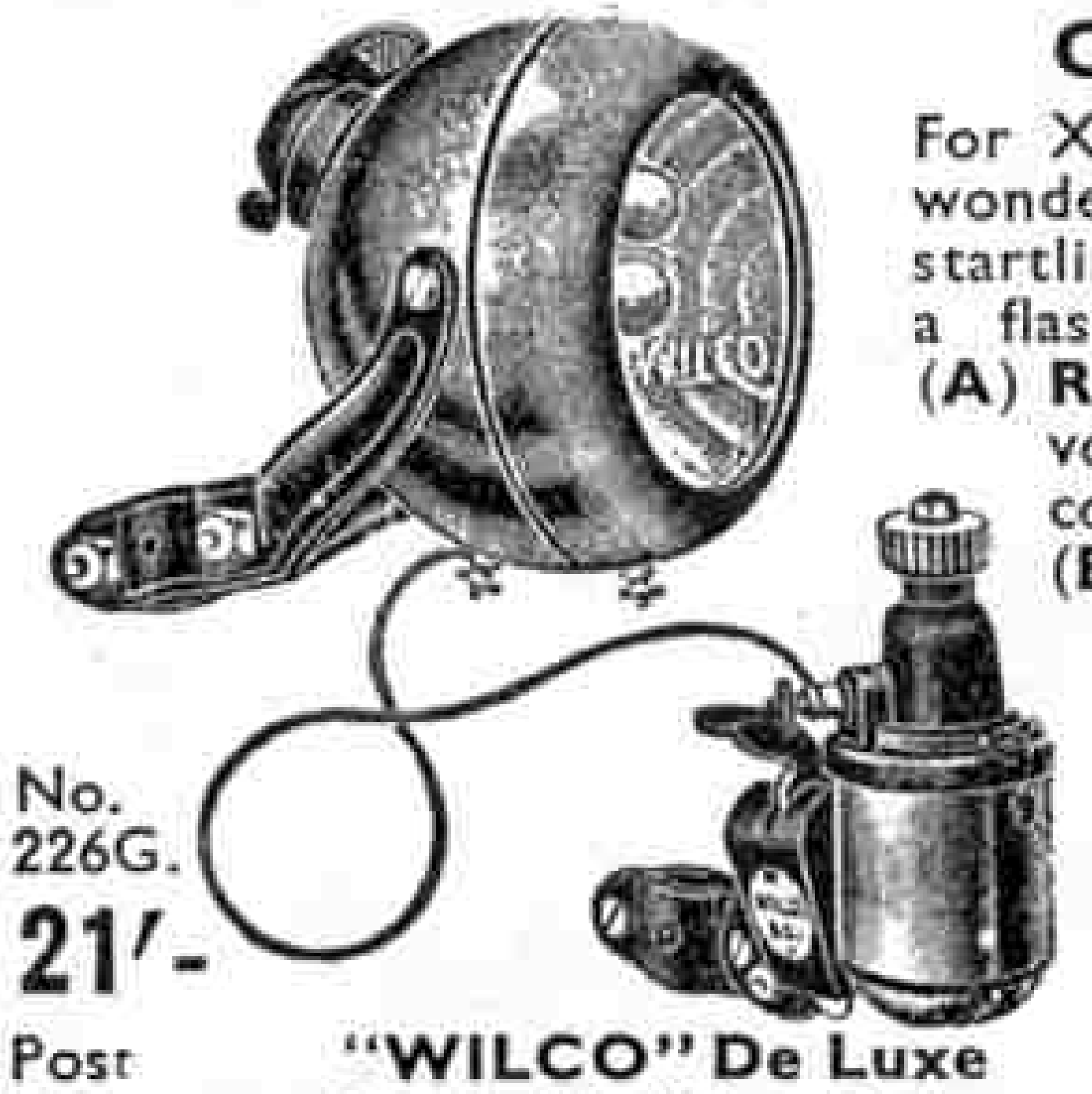

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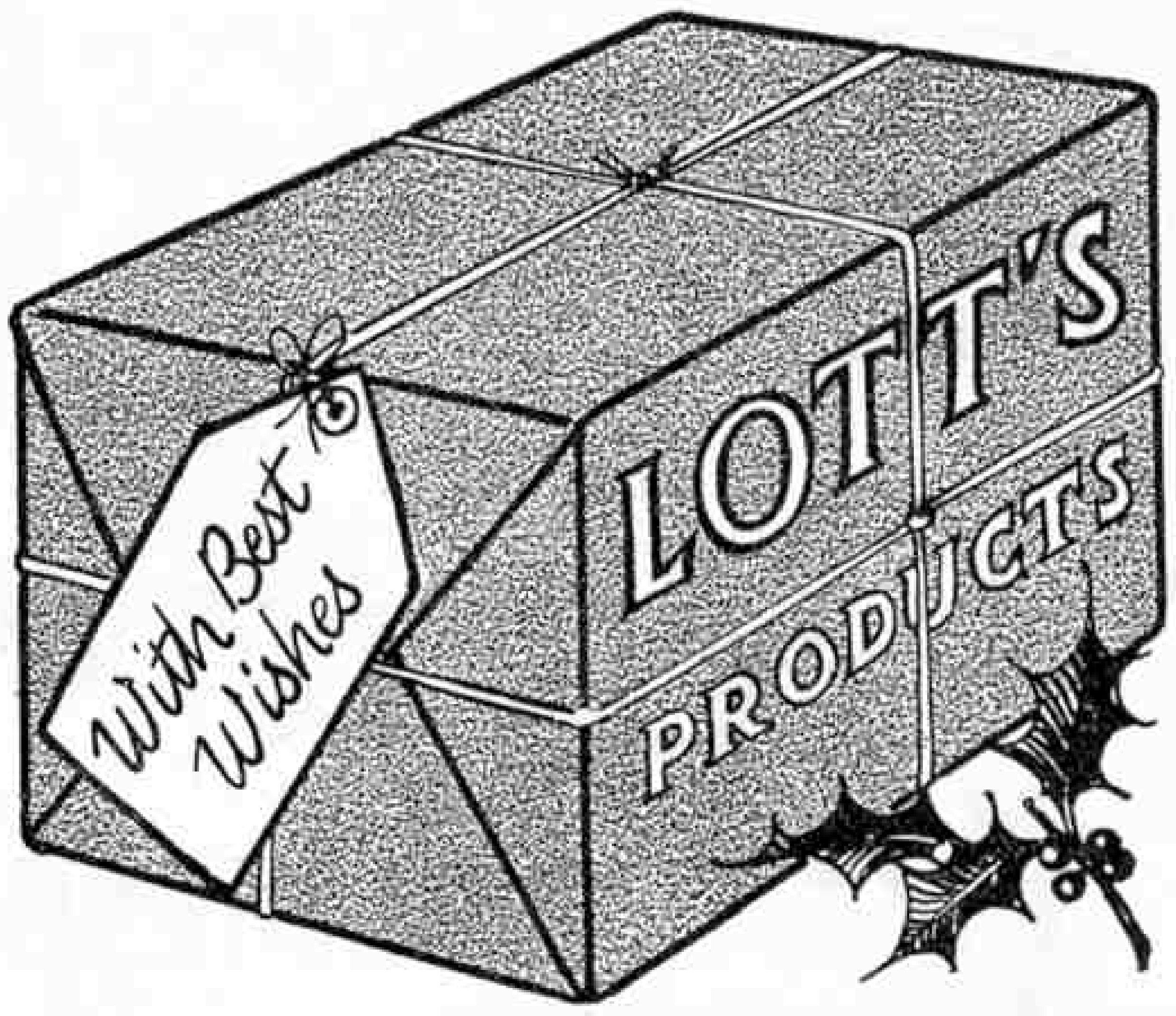

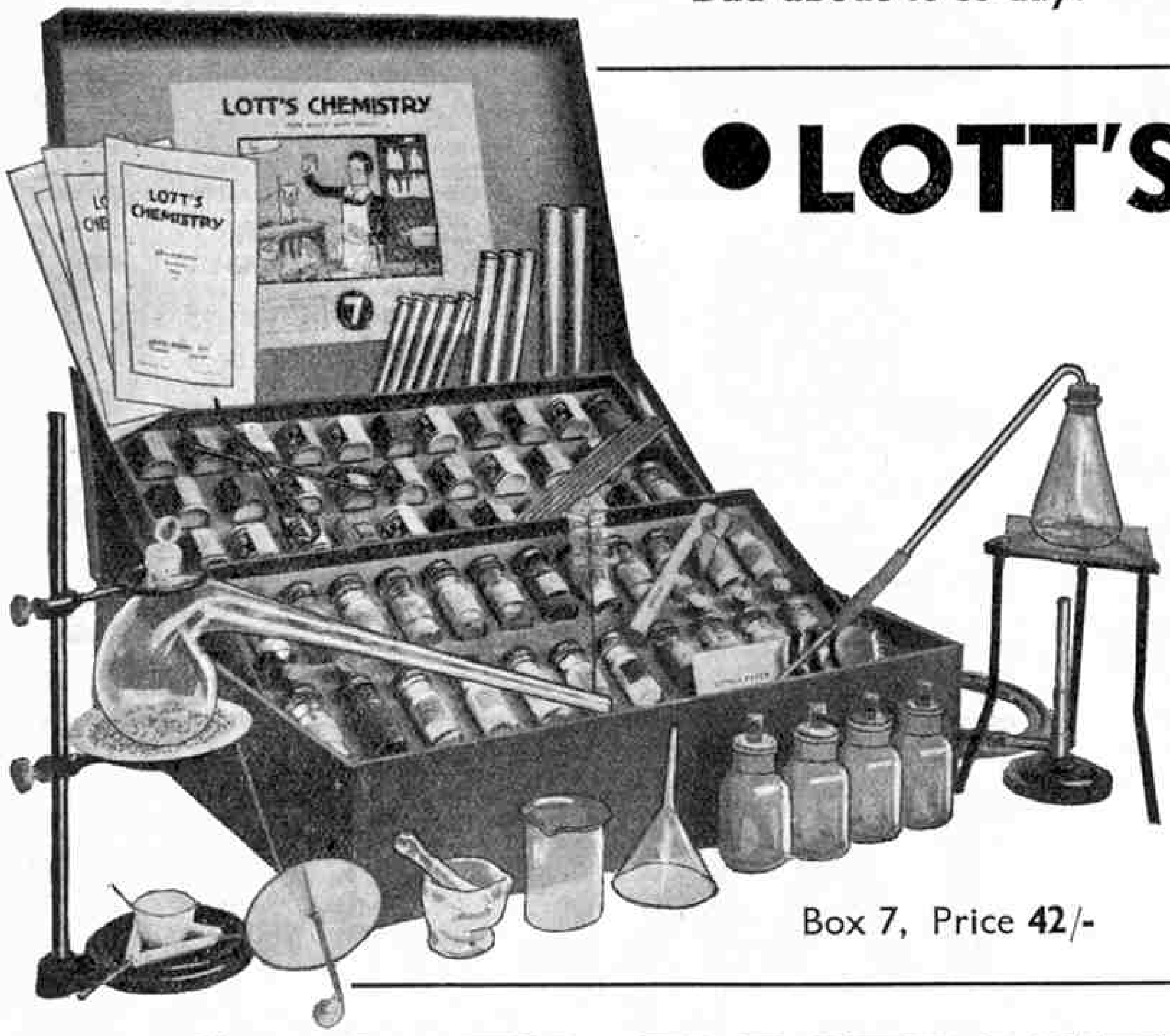

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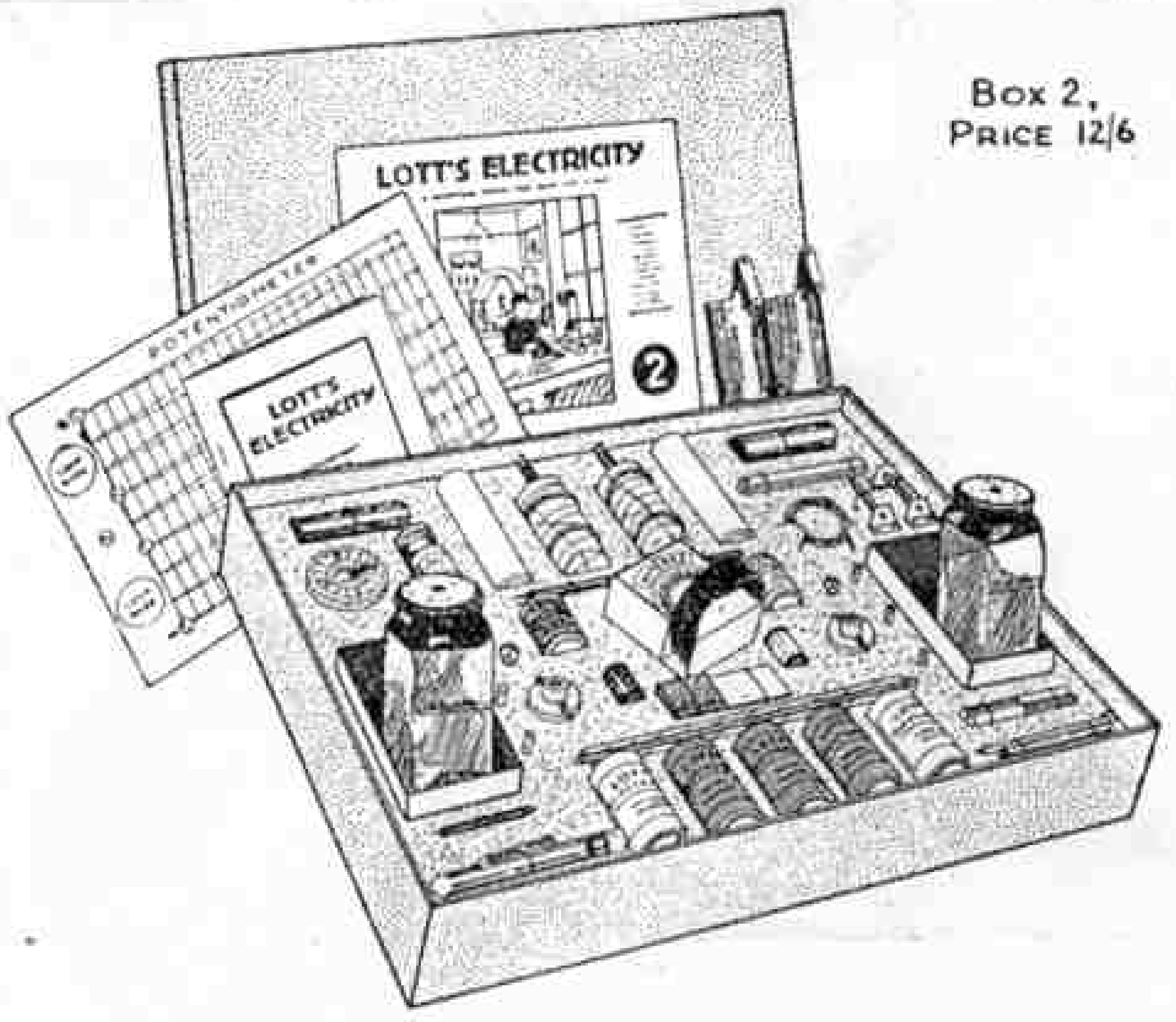

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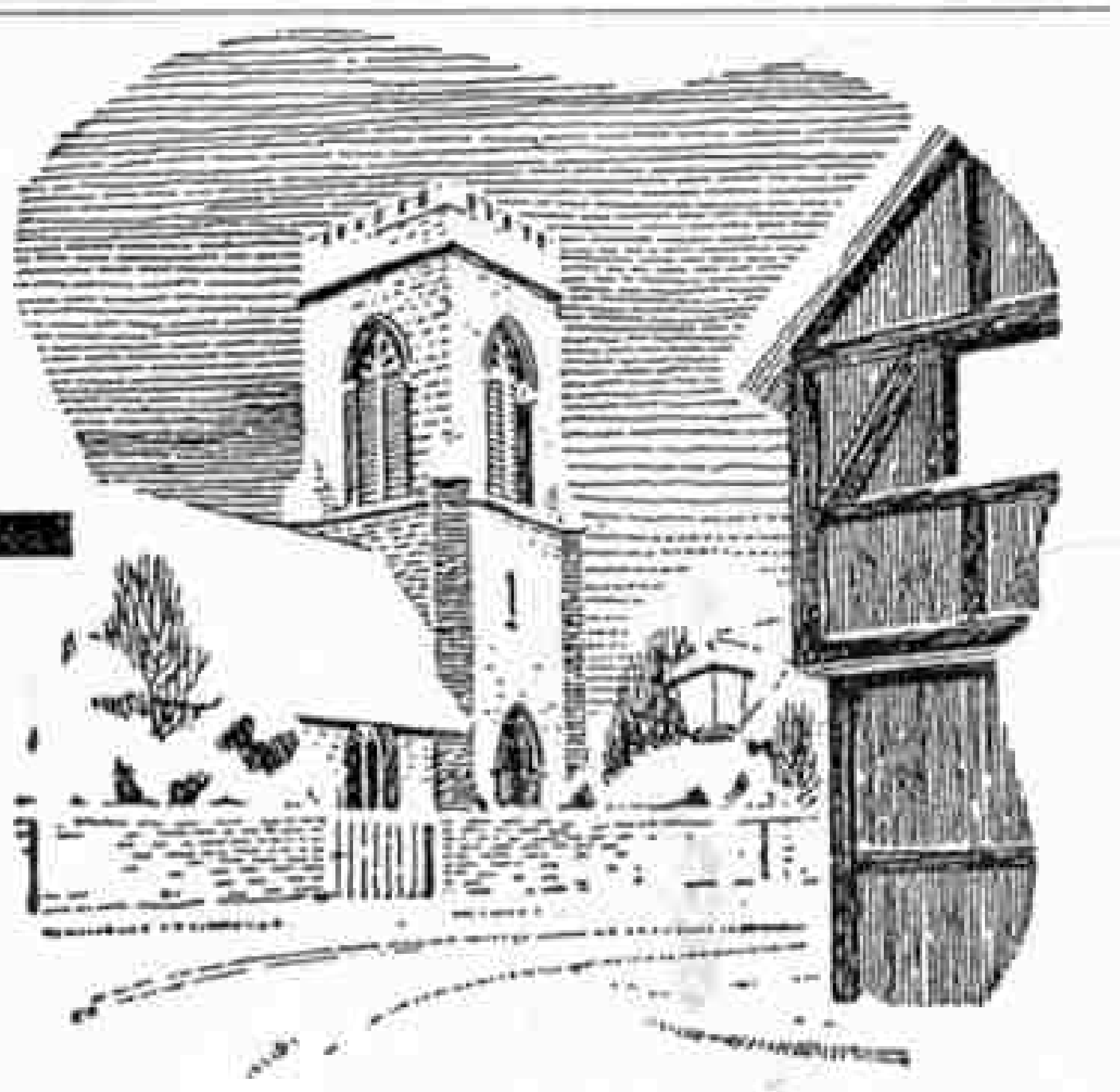

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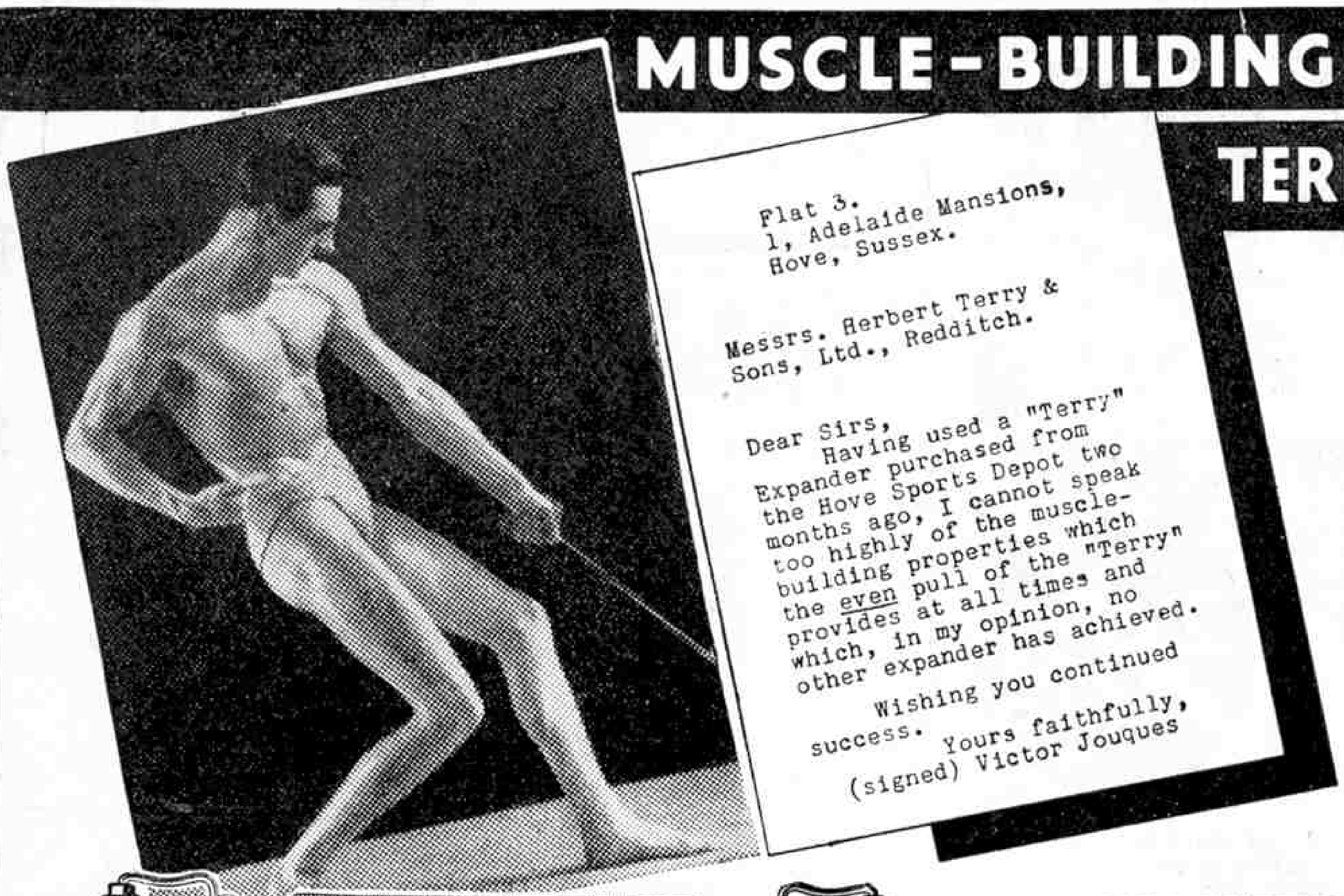

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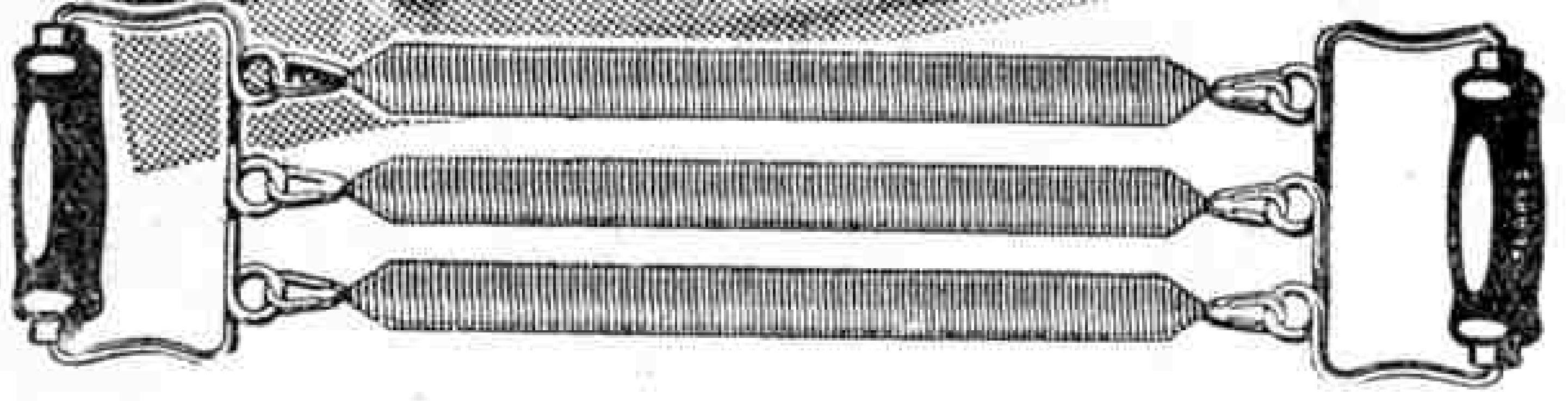

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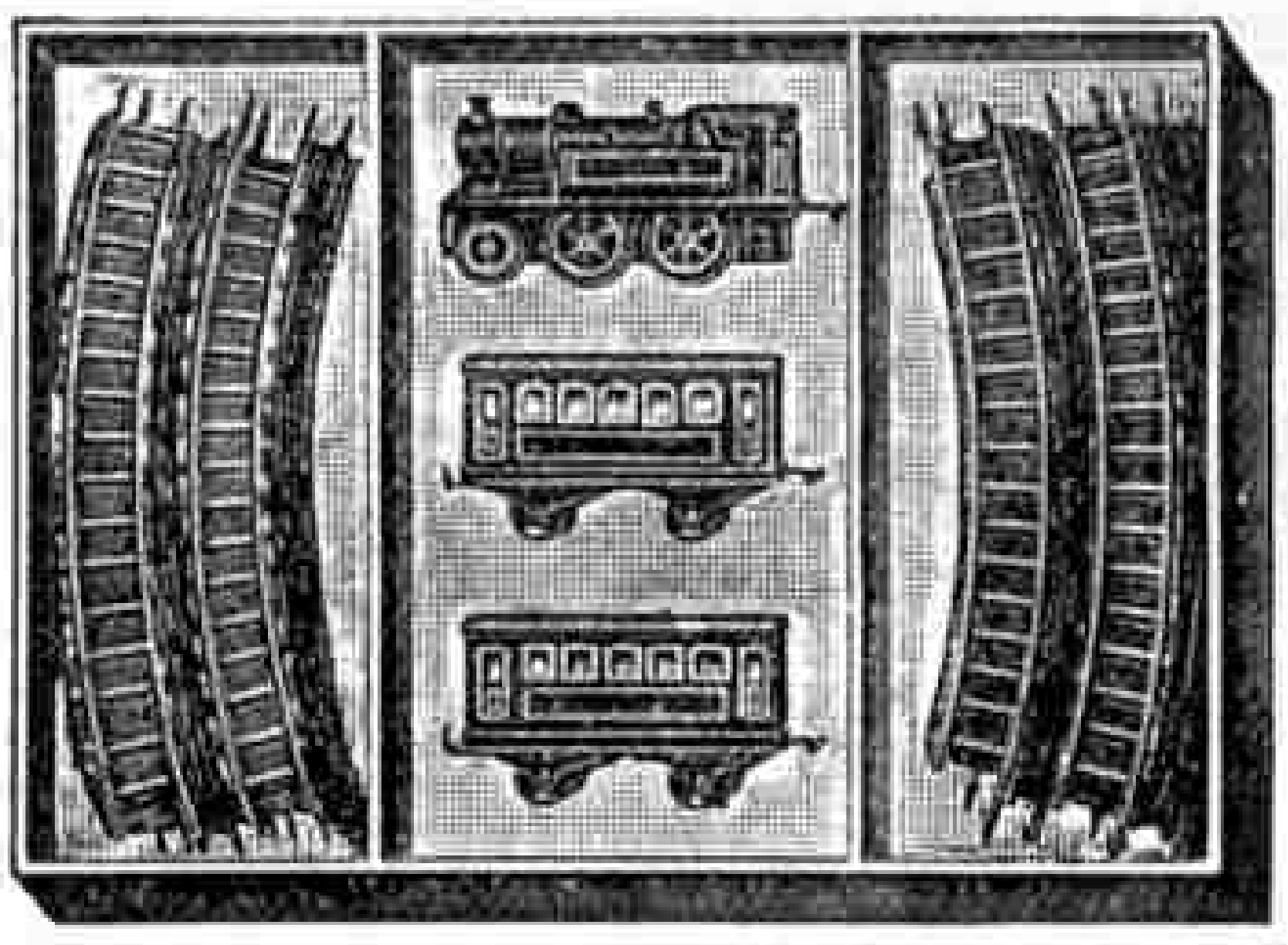

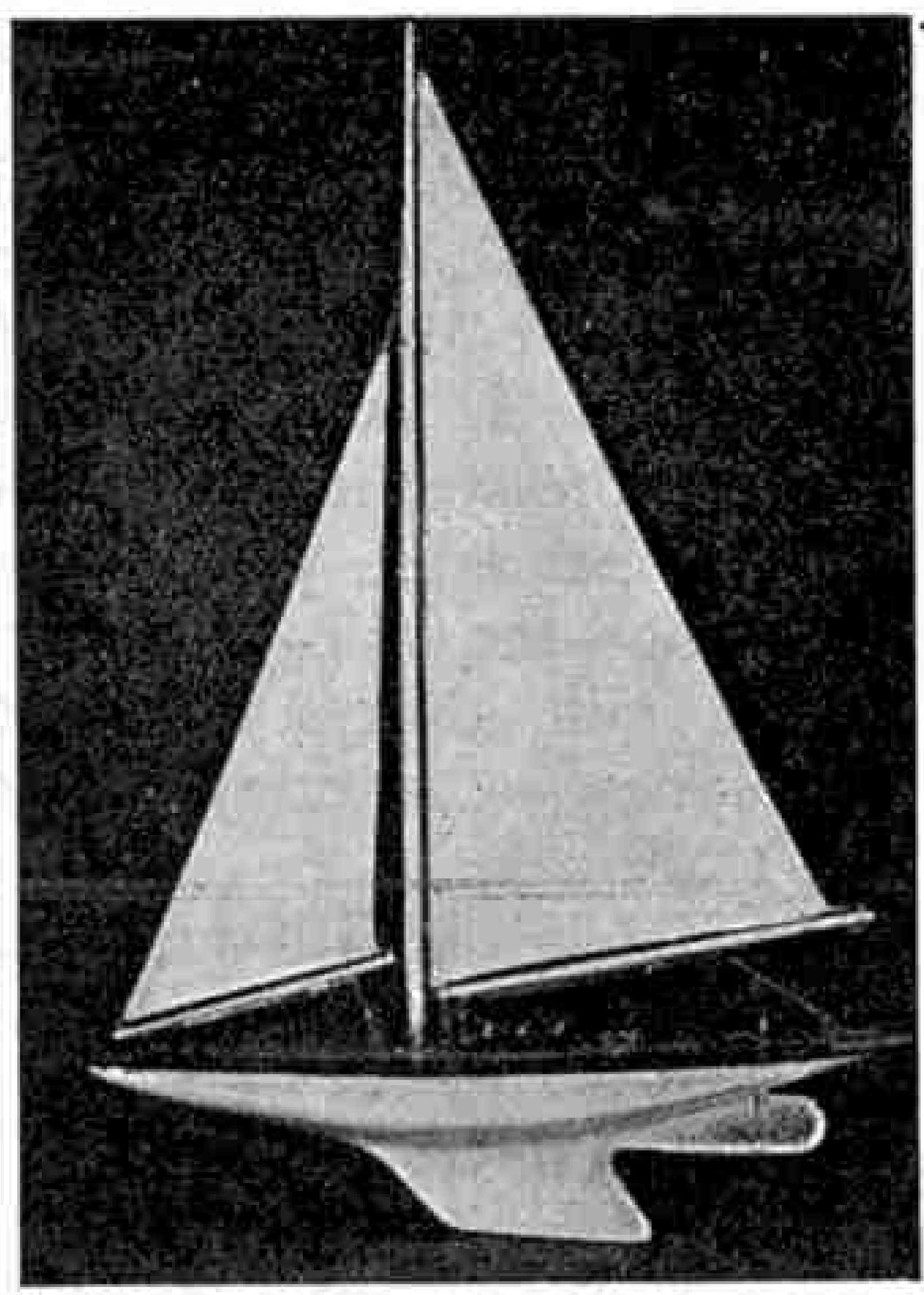

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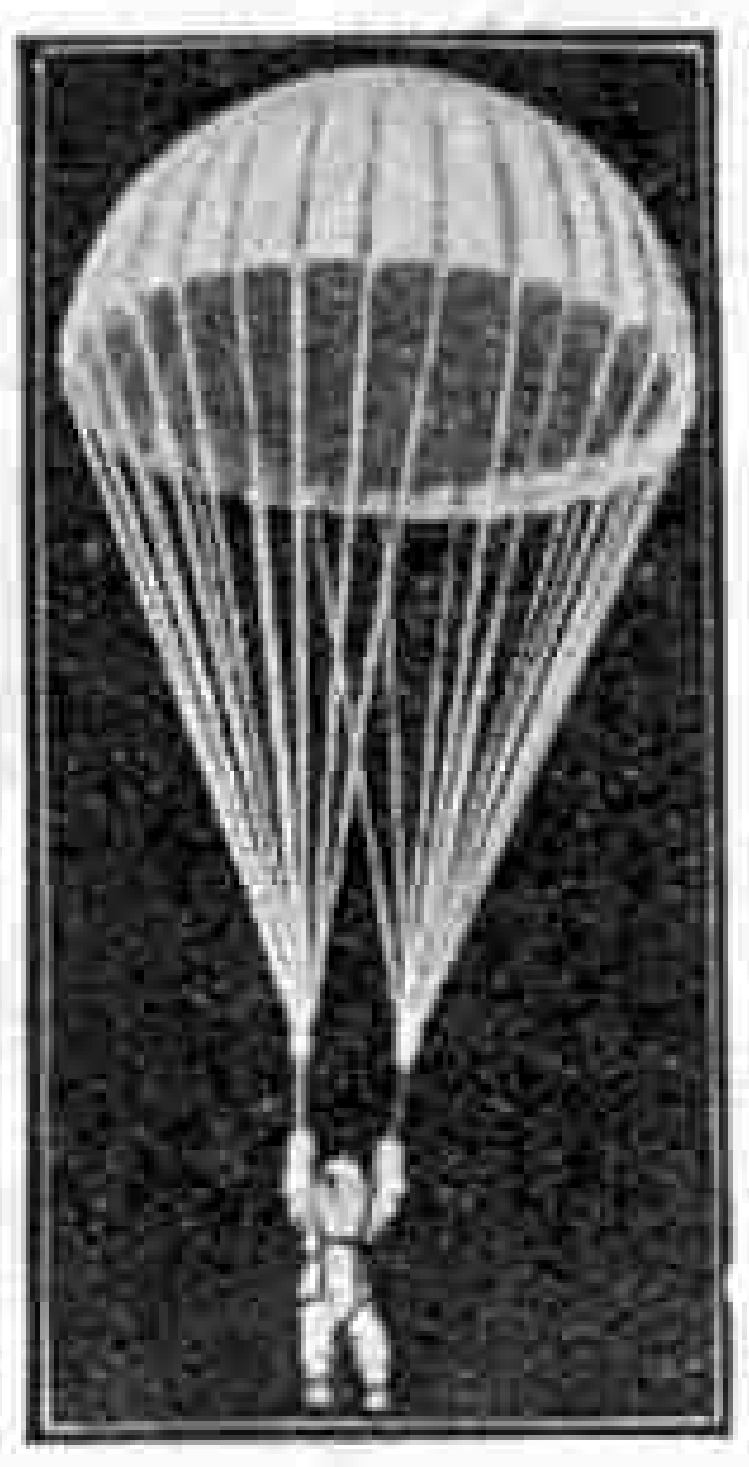

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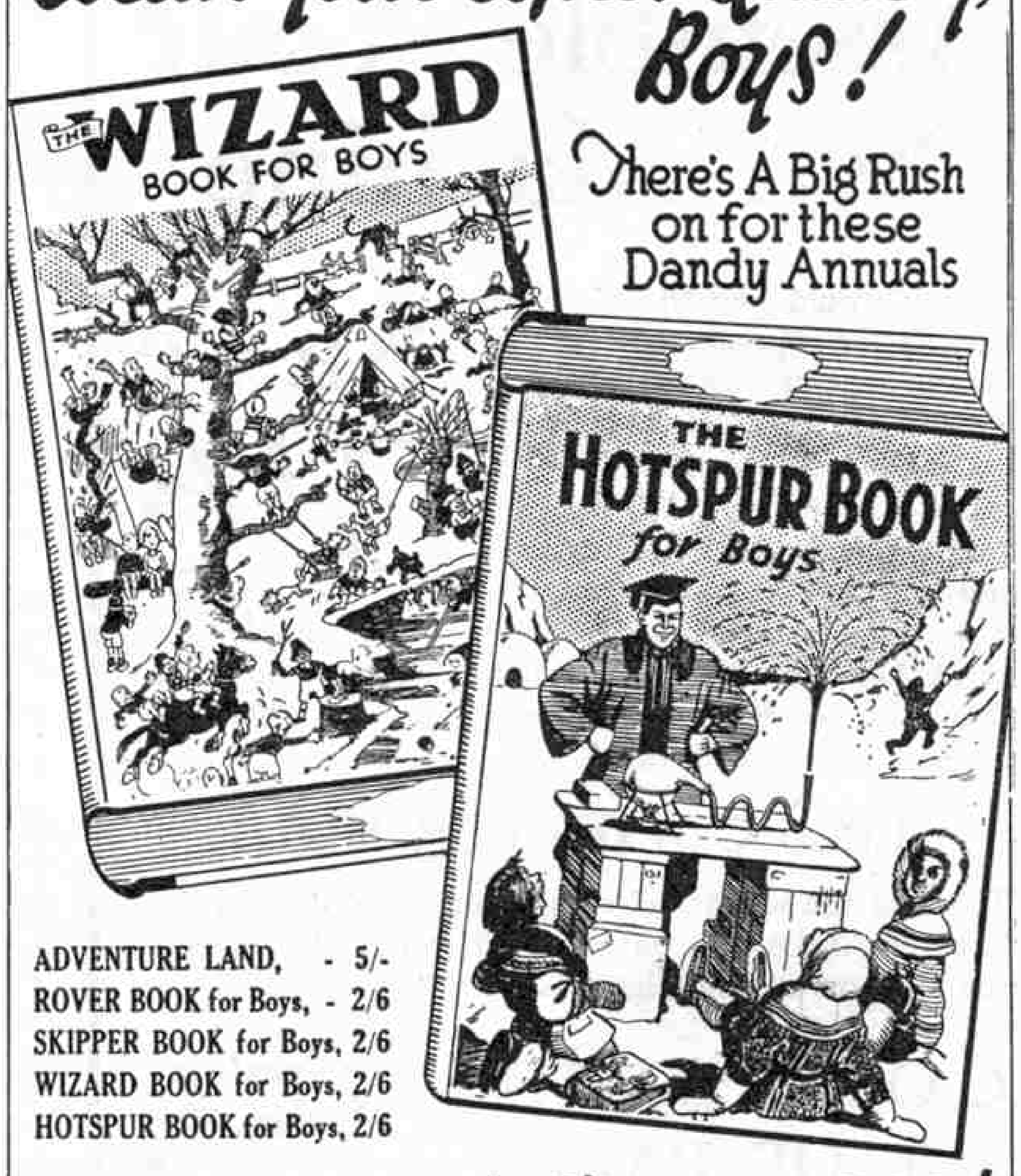
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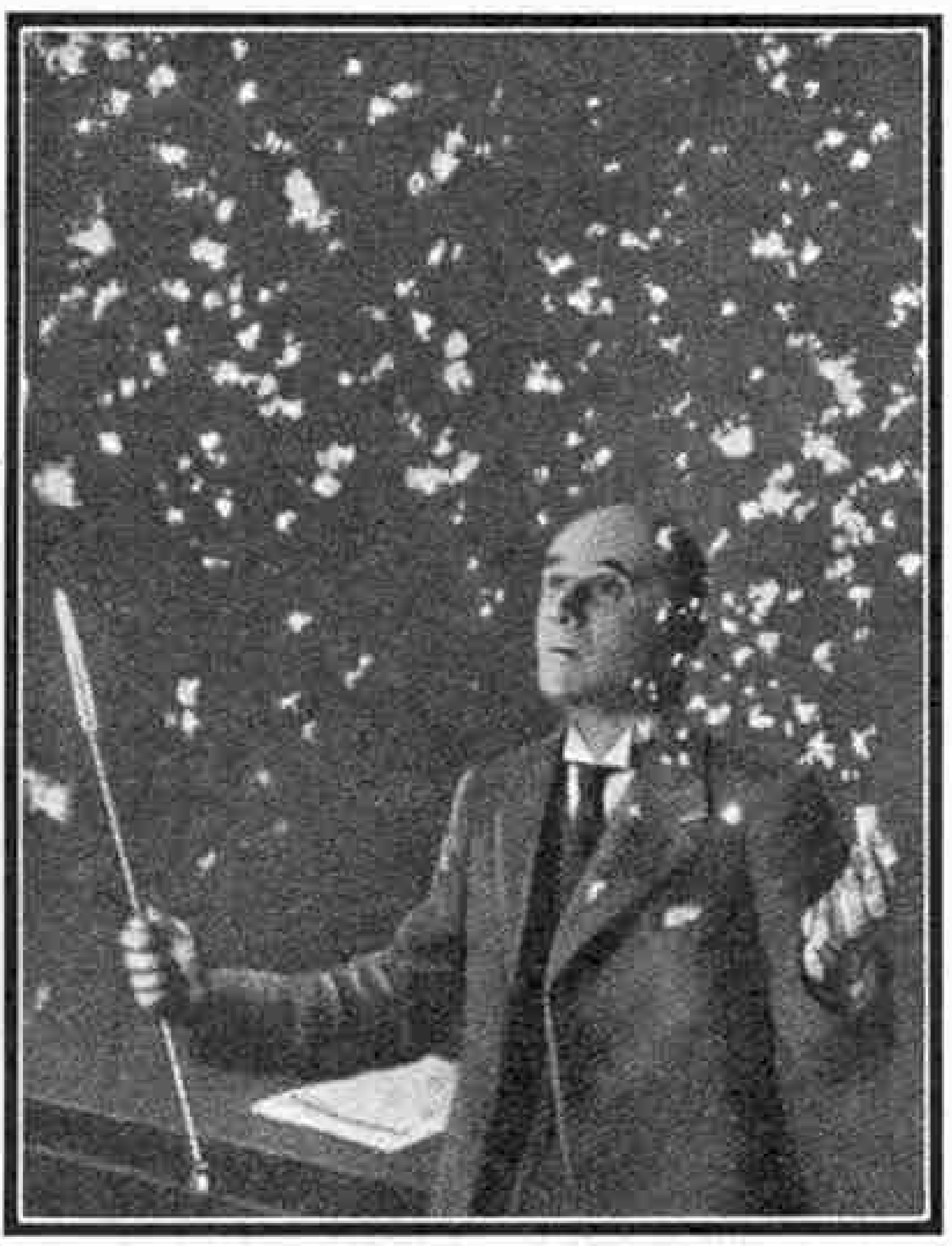

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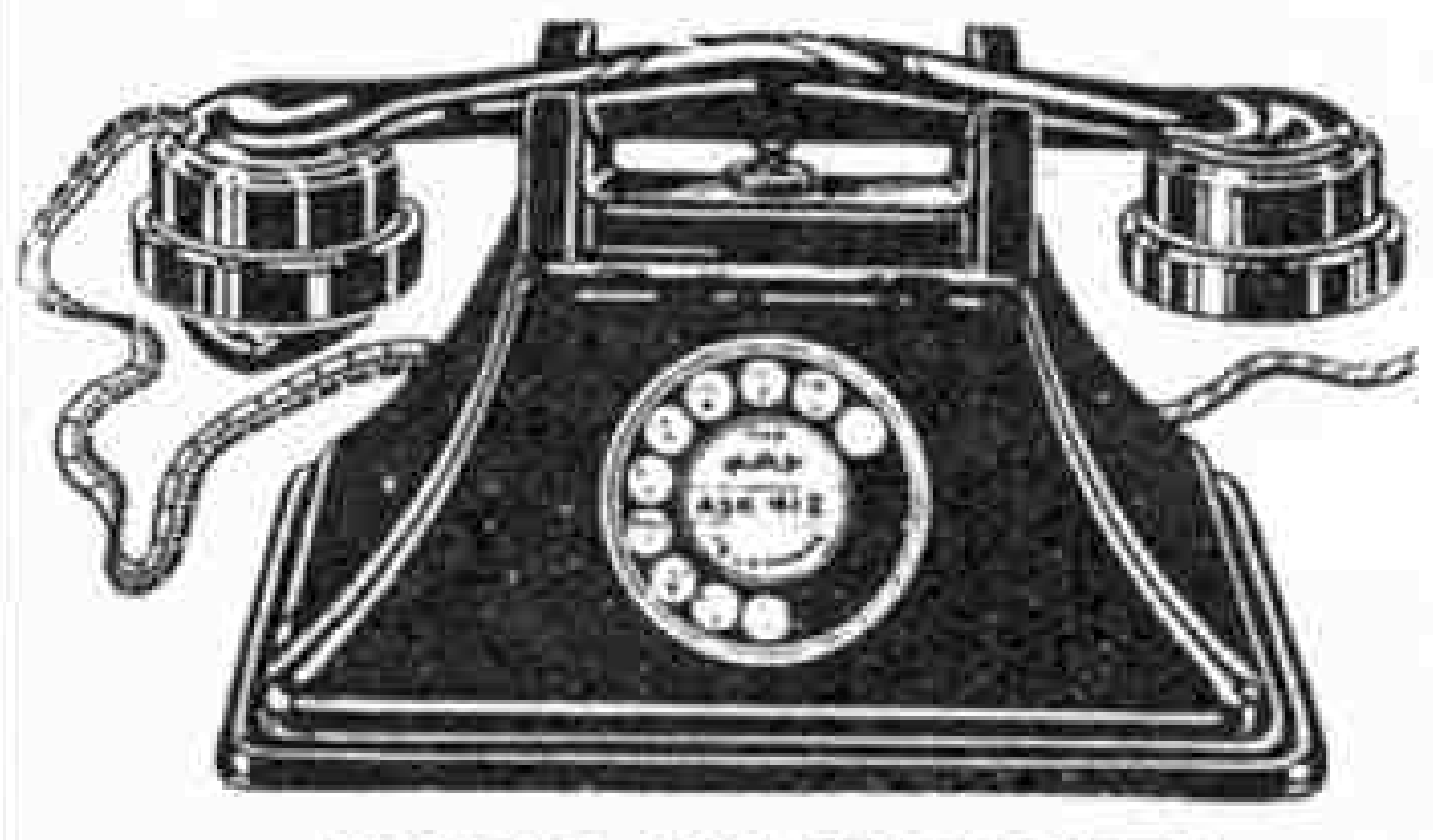

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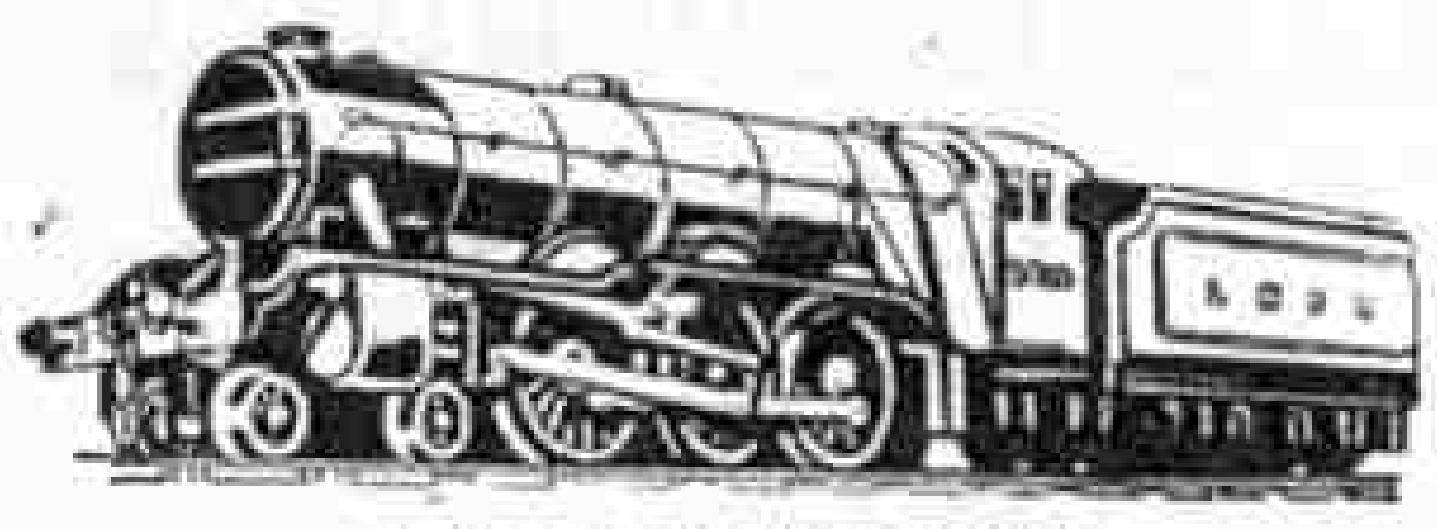

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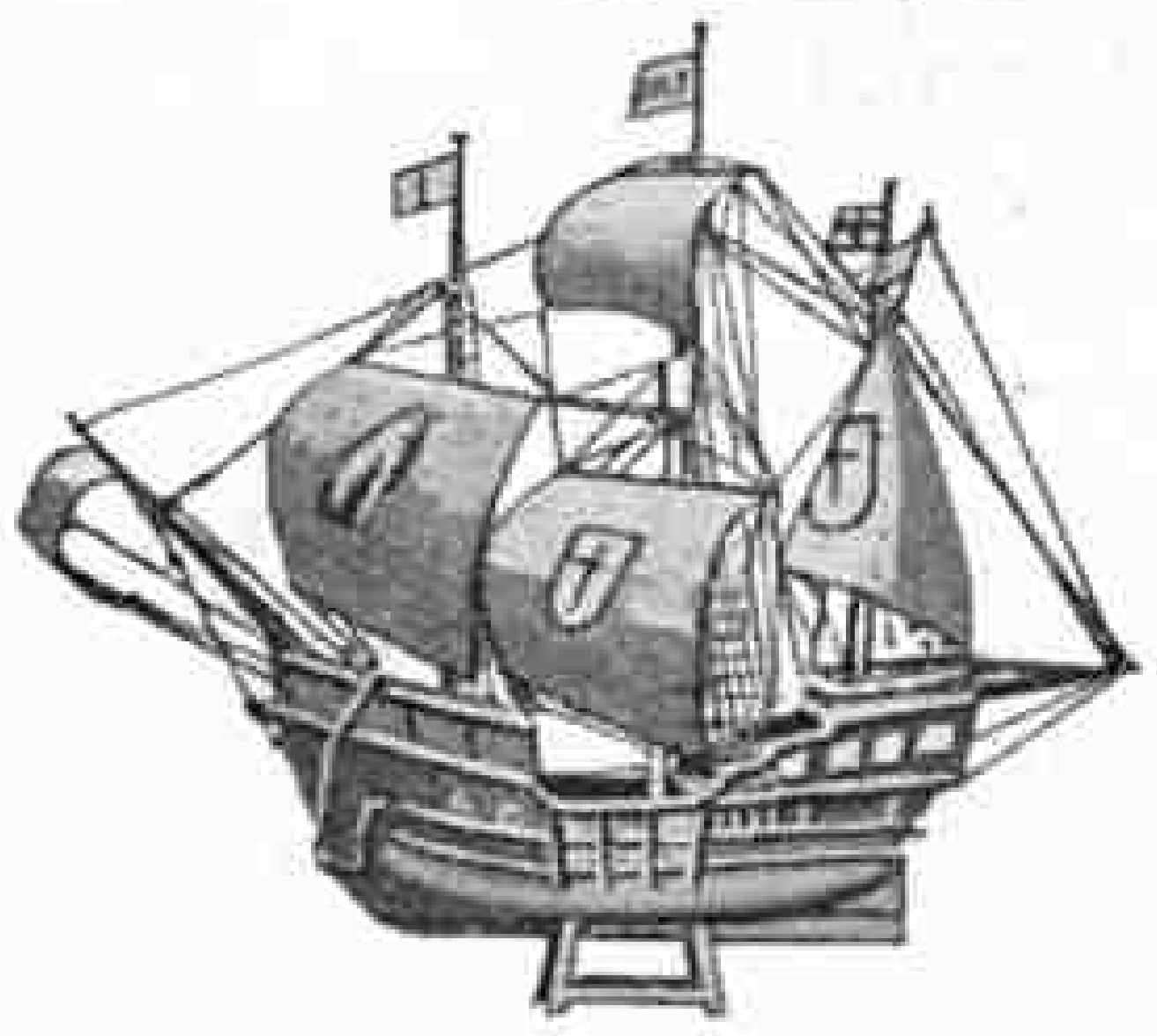

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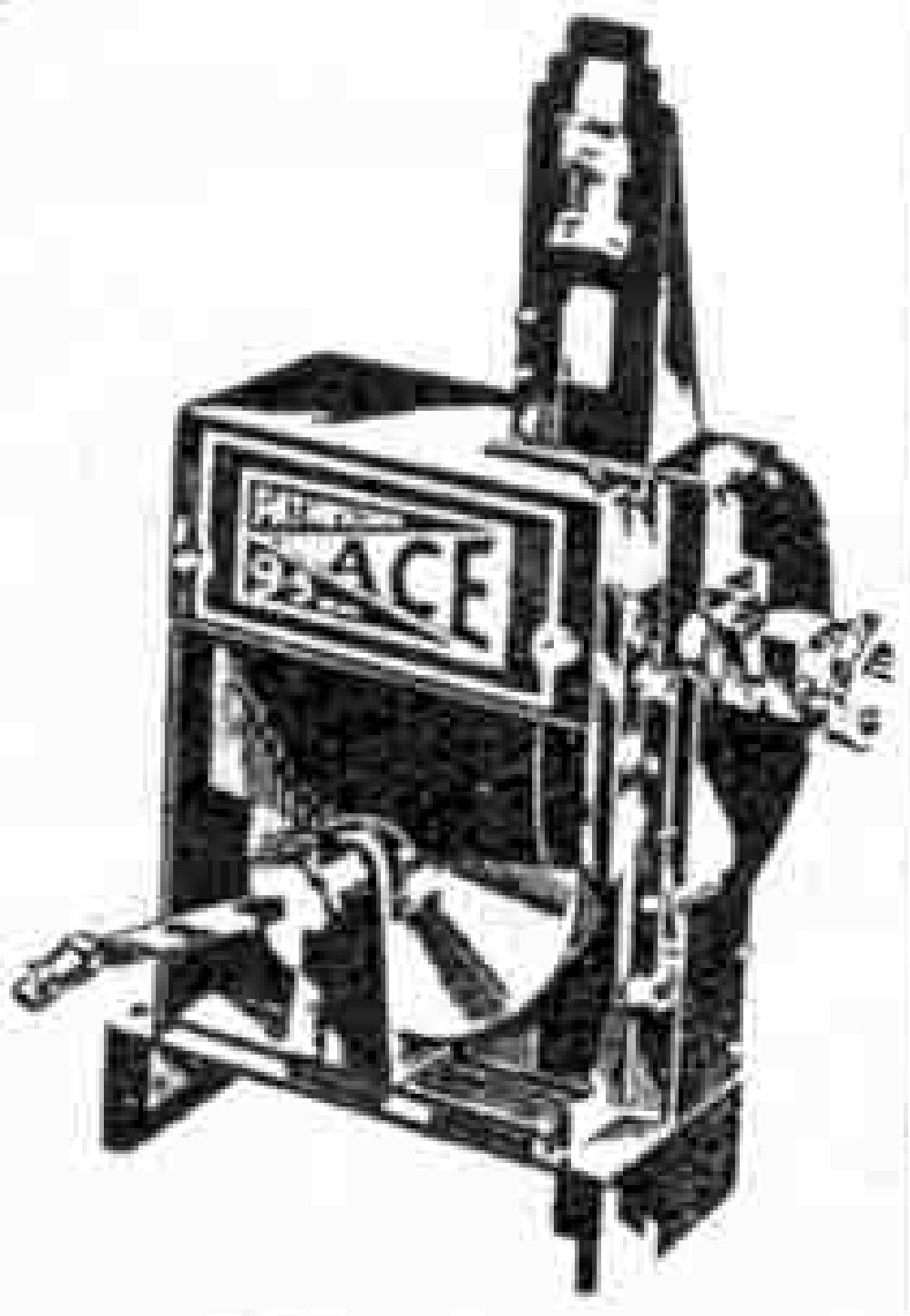

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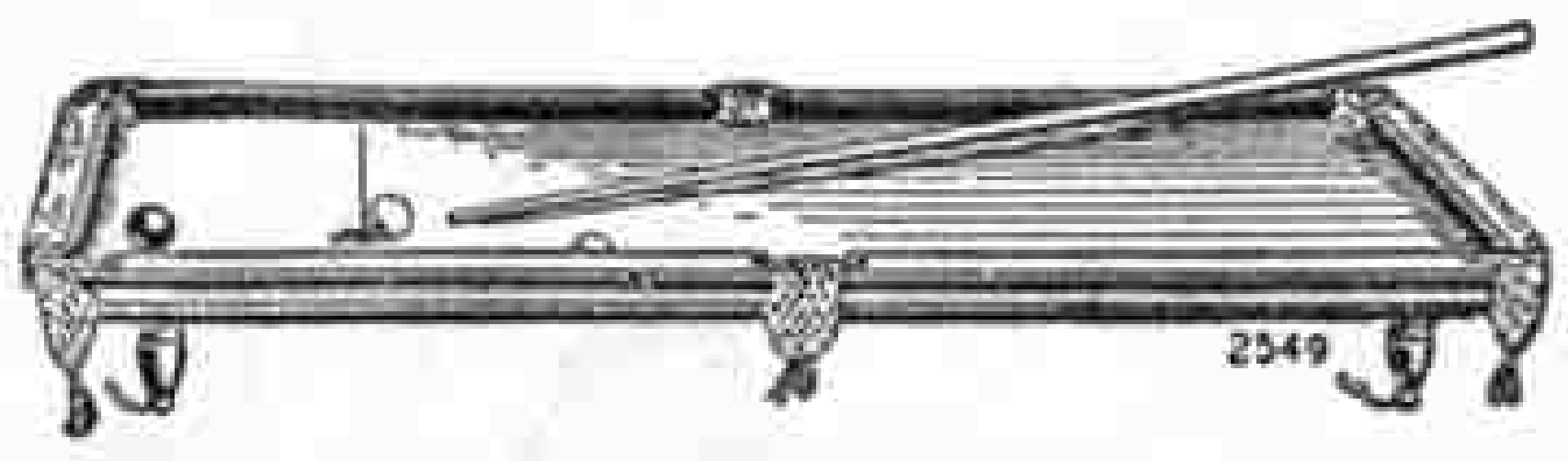

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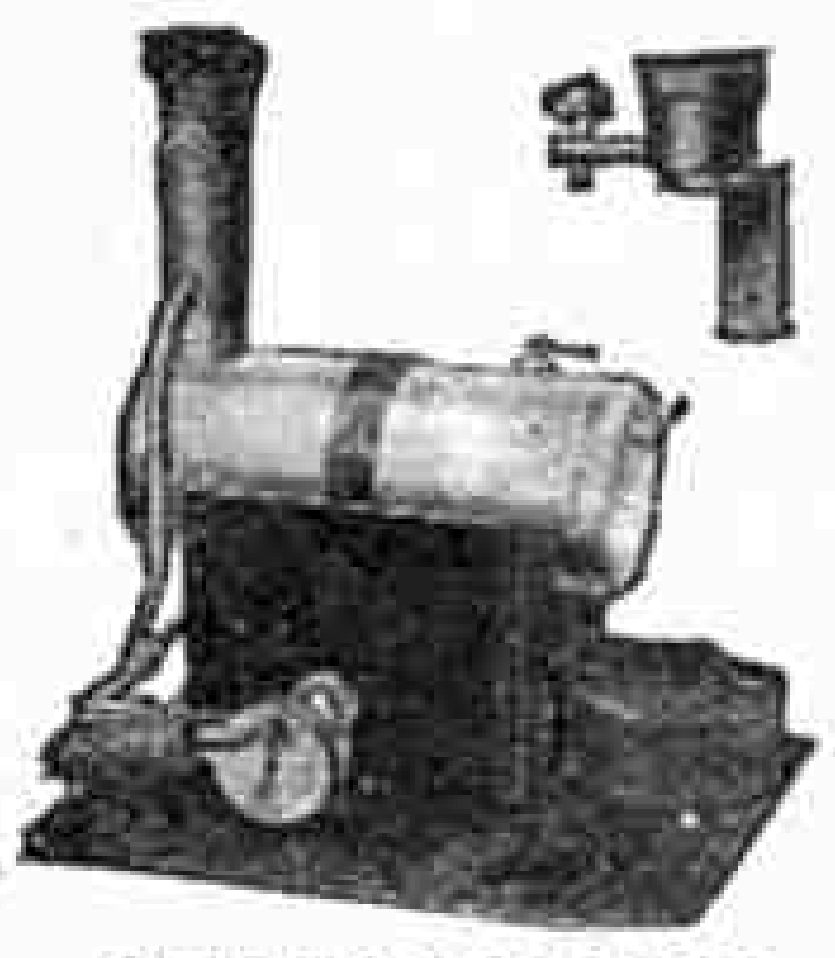

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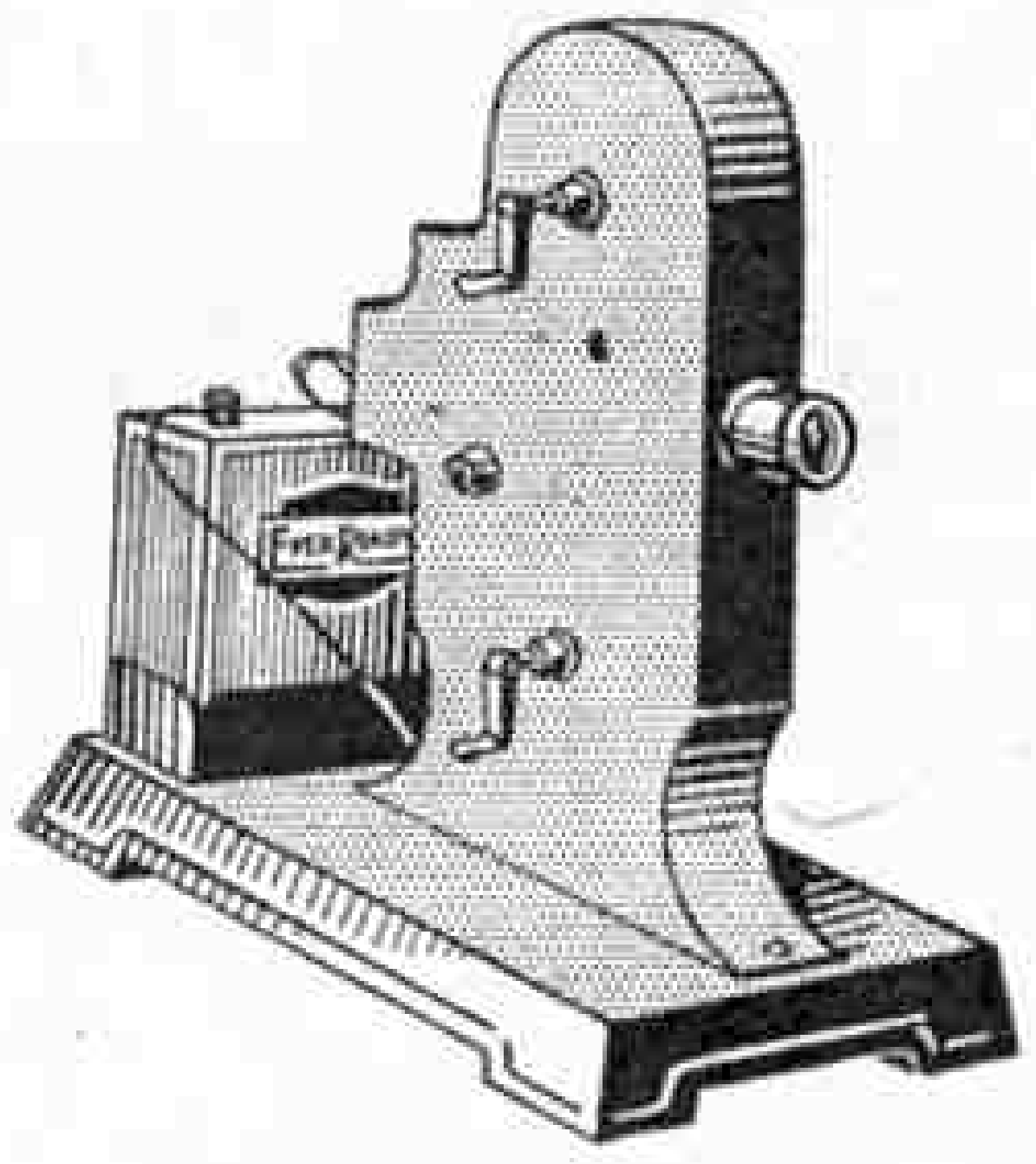

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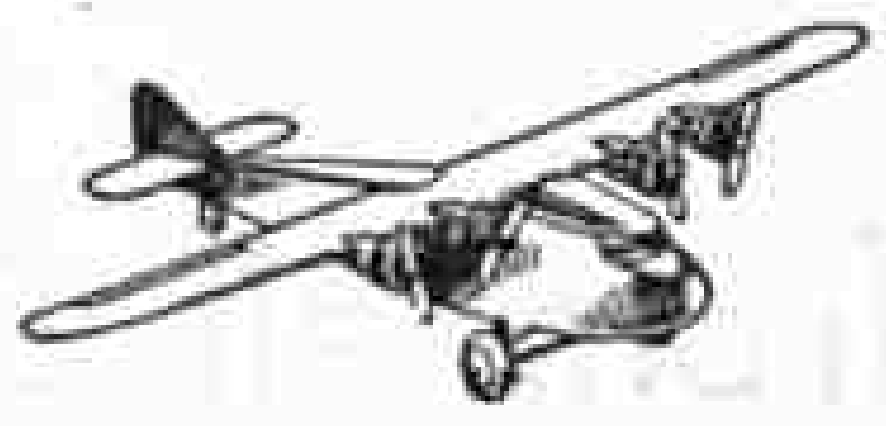

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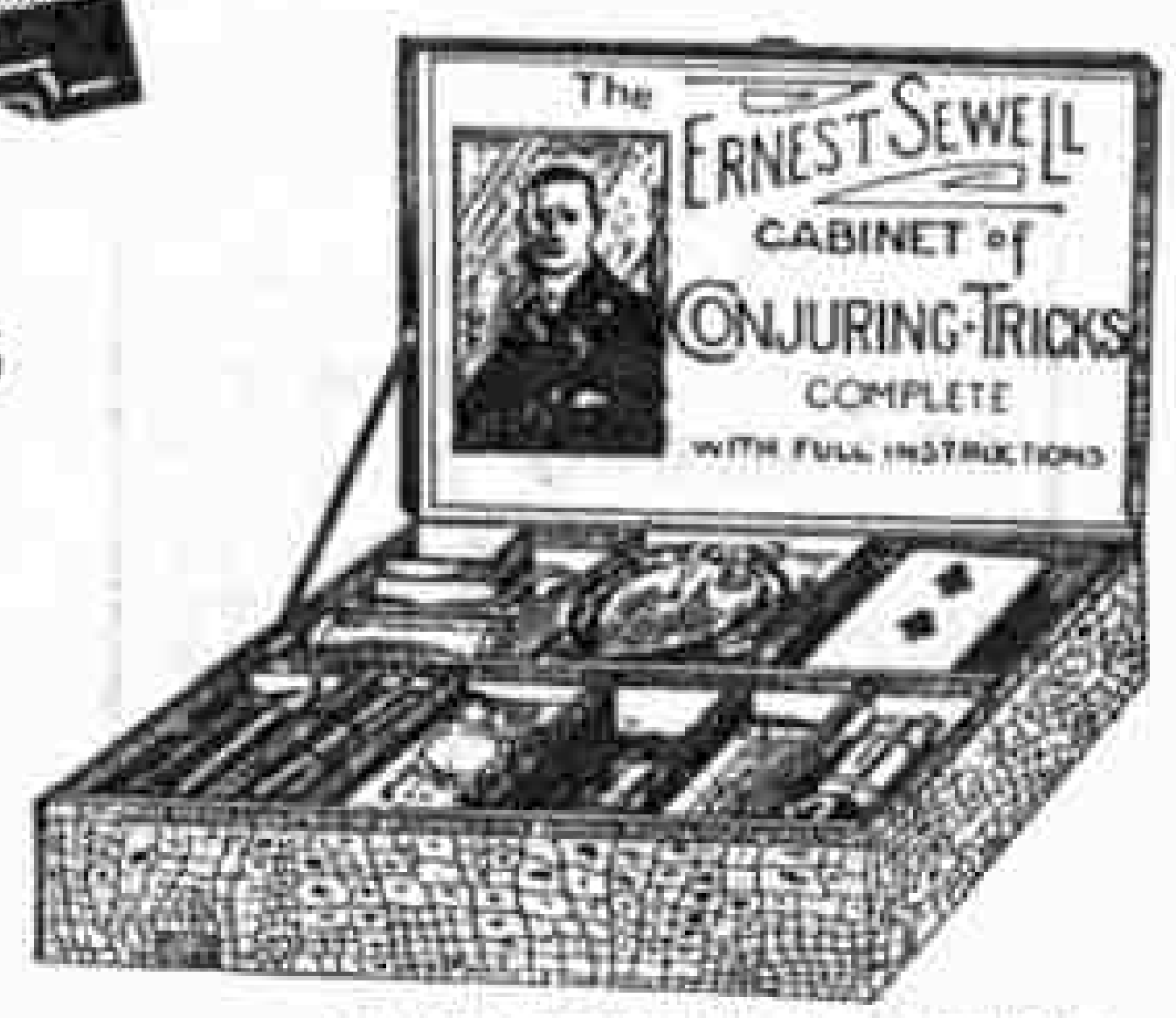
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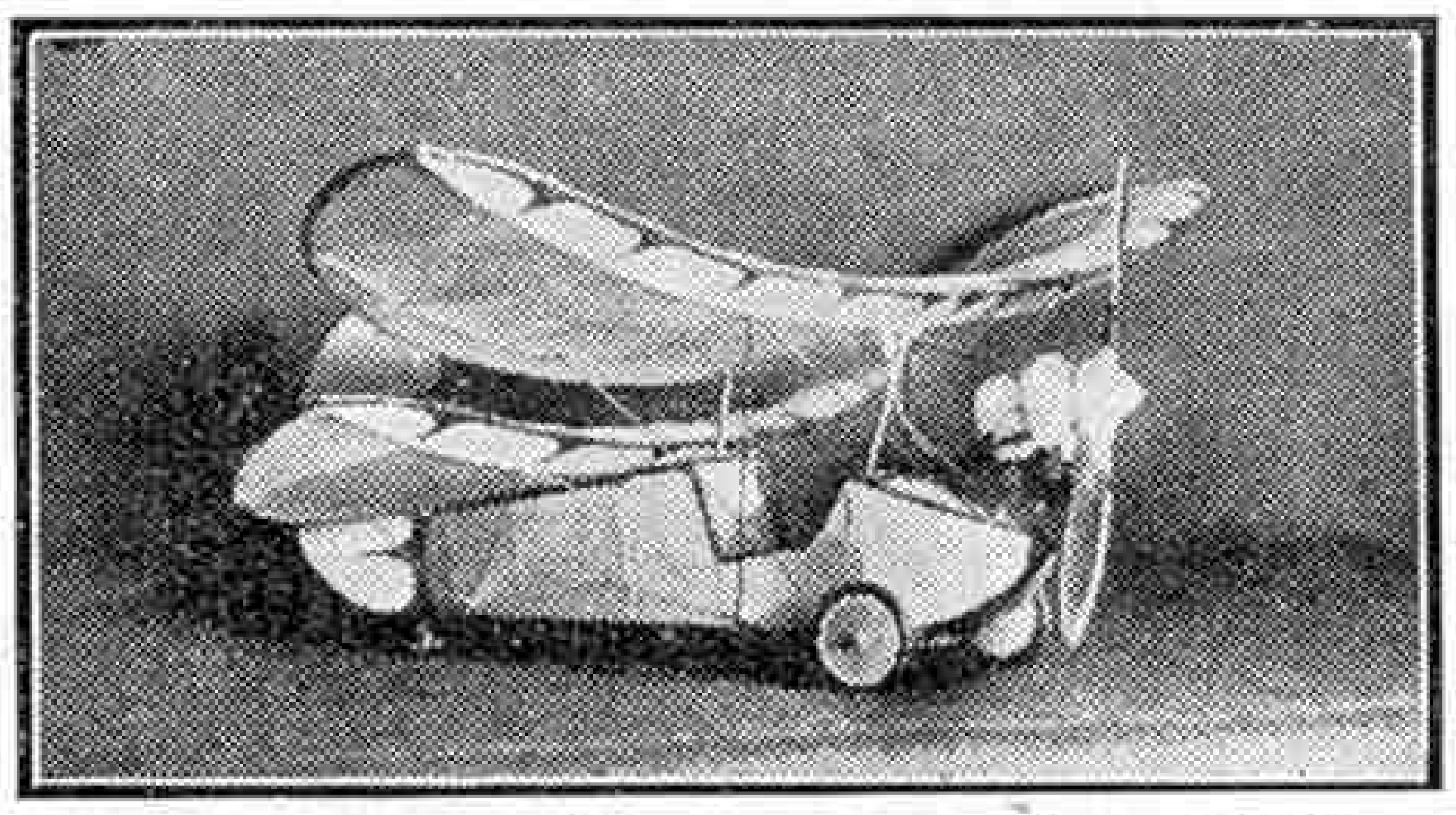

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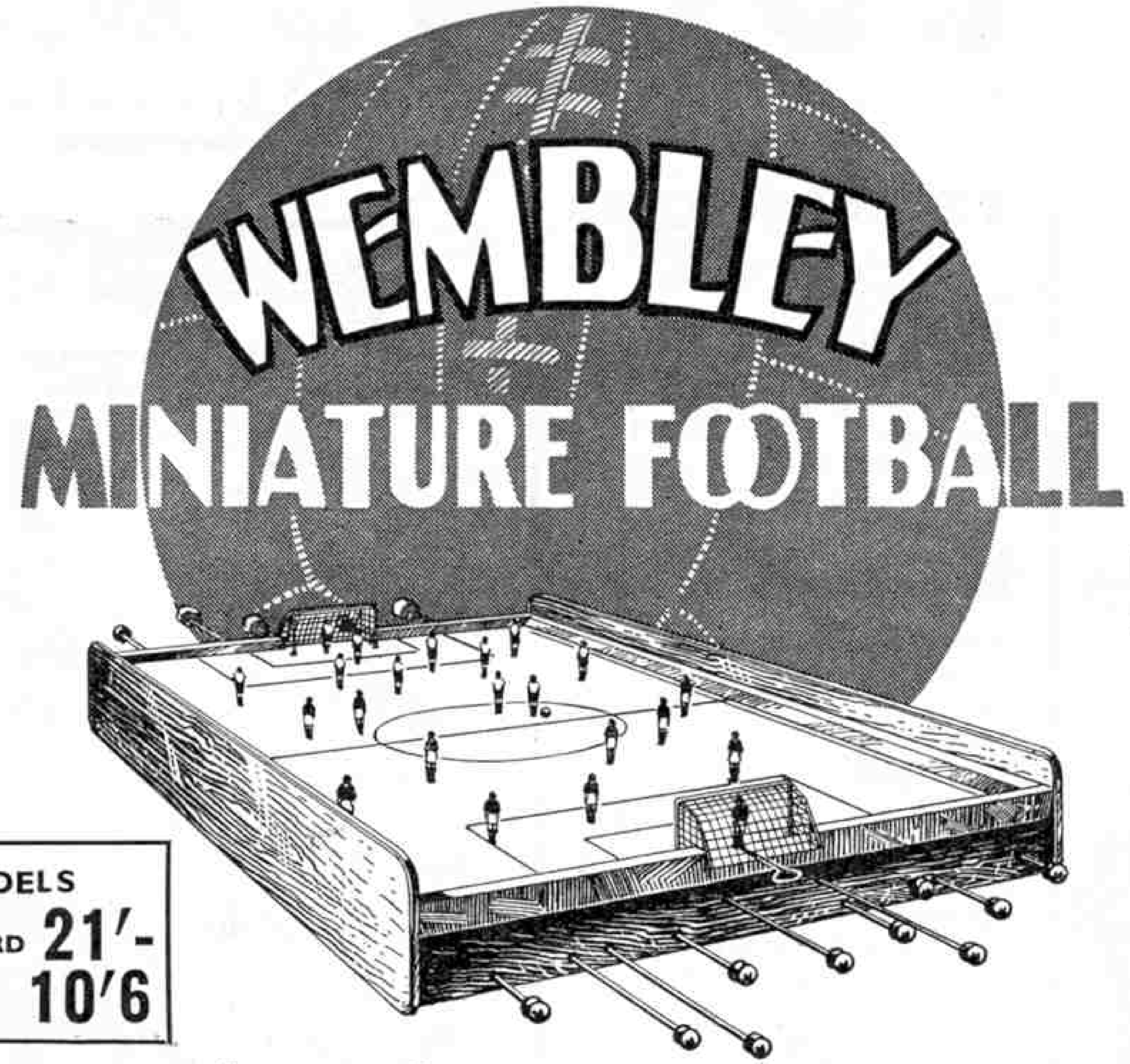

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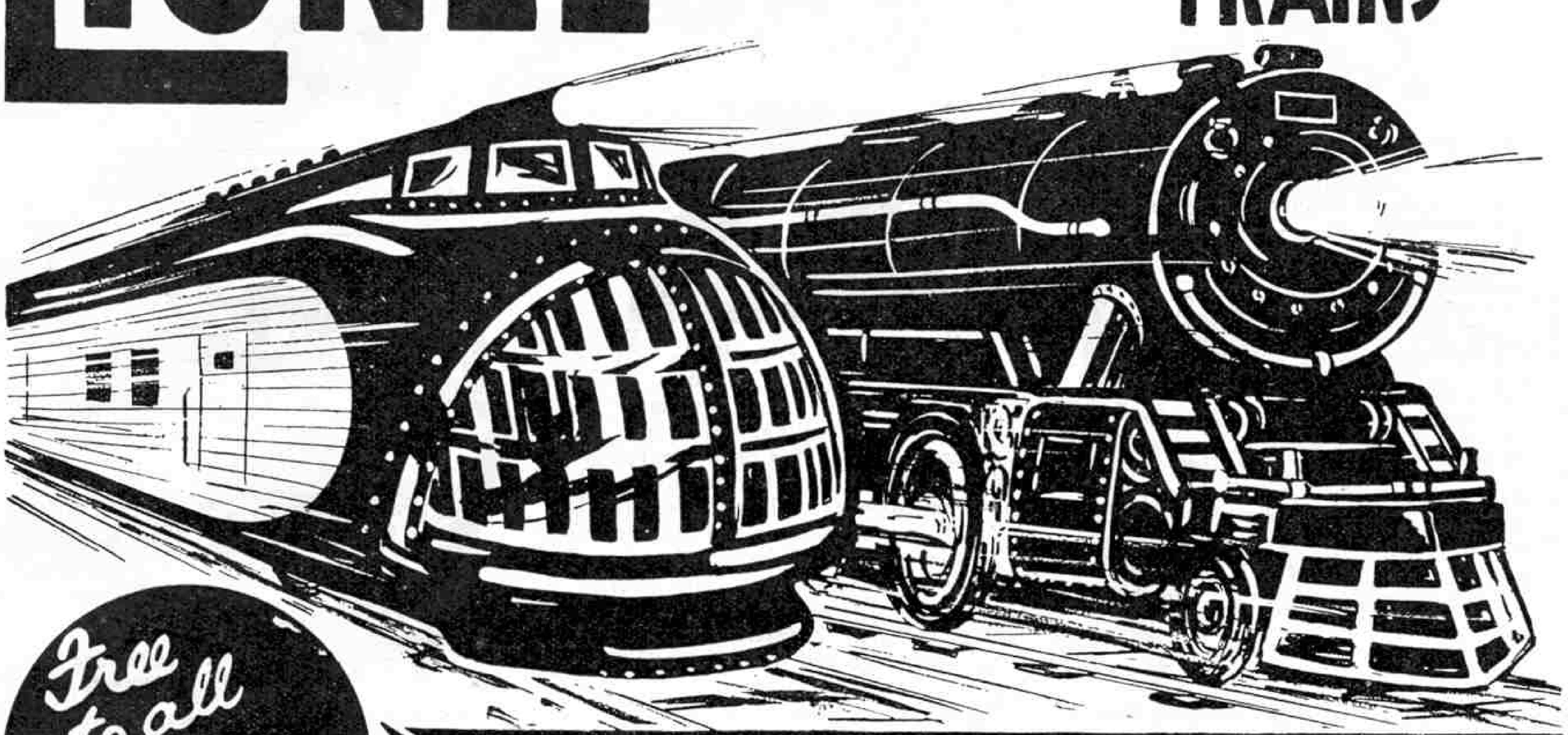
LIONEL ELECTRIC TRAINS



Free to all Train Enthusiasts

A beautifully illustrated catalogue, showing trains, wonderful accessories and interesting track lay-outs, sent absolutely free on request.

(MADE IN U.S.A.)

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S. GUITERMAN & CO. LTD.
(LIONEL SERVICE DEPT. 3),
35/36, ALDERMANBURY, E.C.2.
When writing please give name of your favourite dealer

LIONEL ELECTRIC TRAINS ARE OBTAINABLE FROM MOST HIGH-CLASS STORES AND TOY SHOPS

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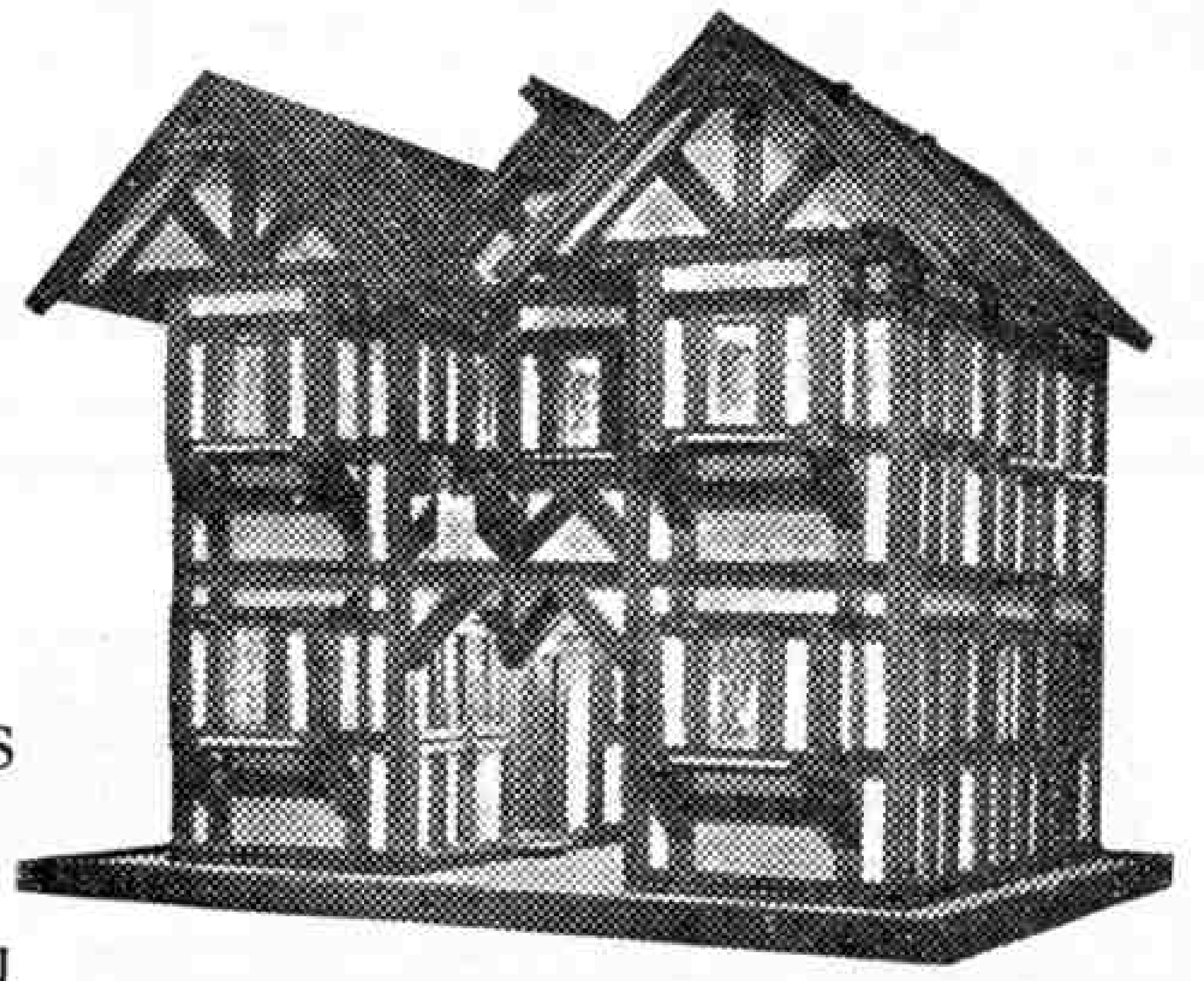
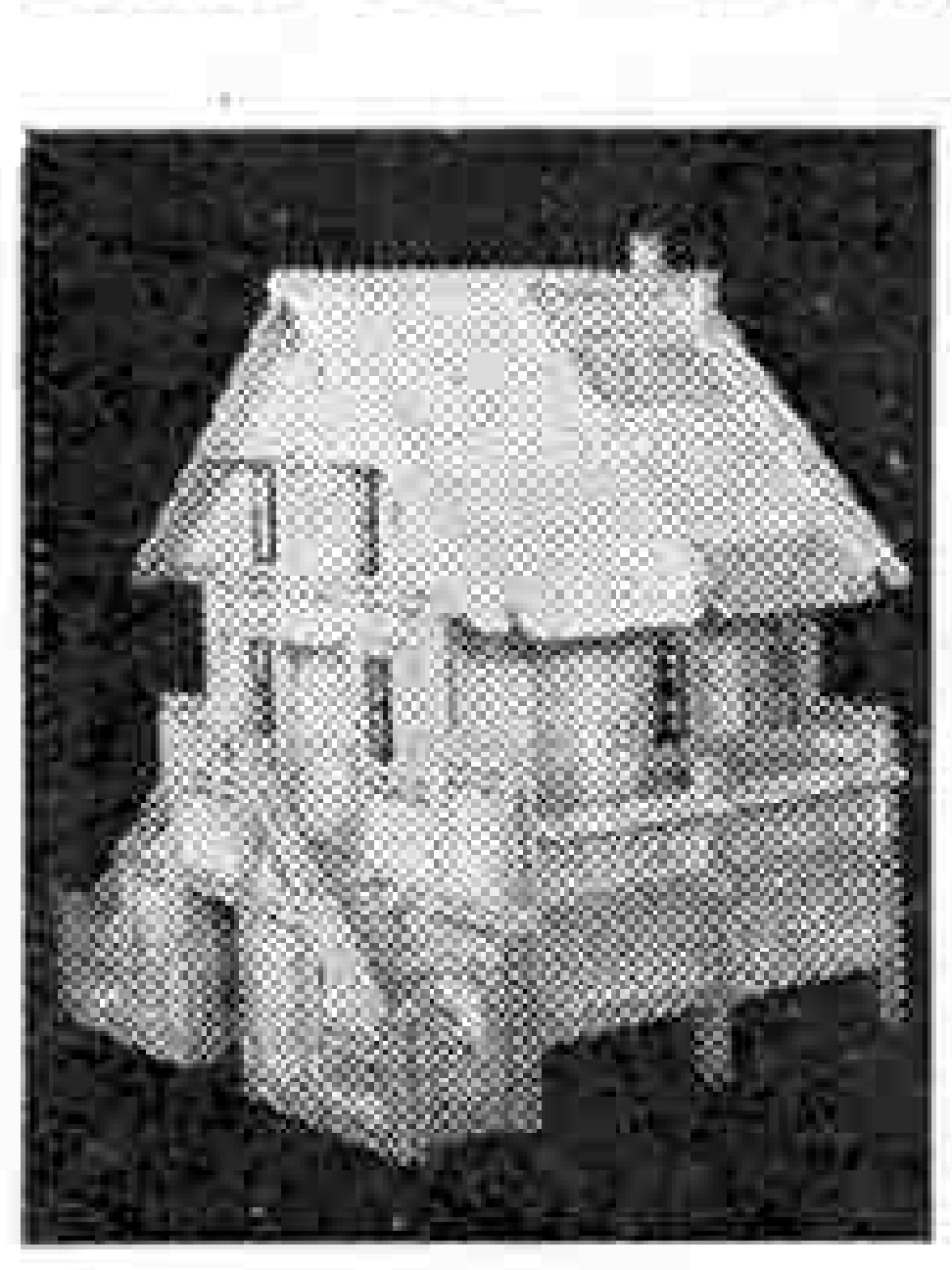


With Edifix you can build these and countless other life-like model buildings and working models that are correct in every detail. You simply fit three-ply panels into grooved lengths of beech-wood to make strong structures that can be moved about wherever you like. Tell Dad you'd like a set for Christmas.



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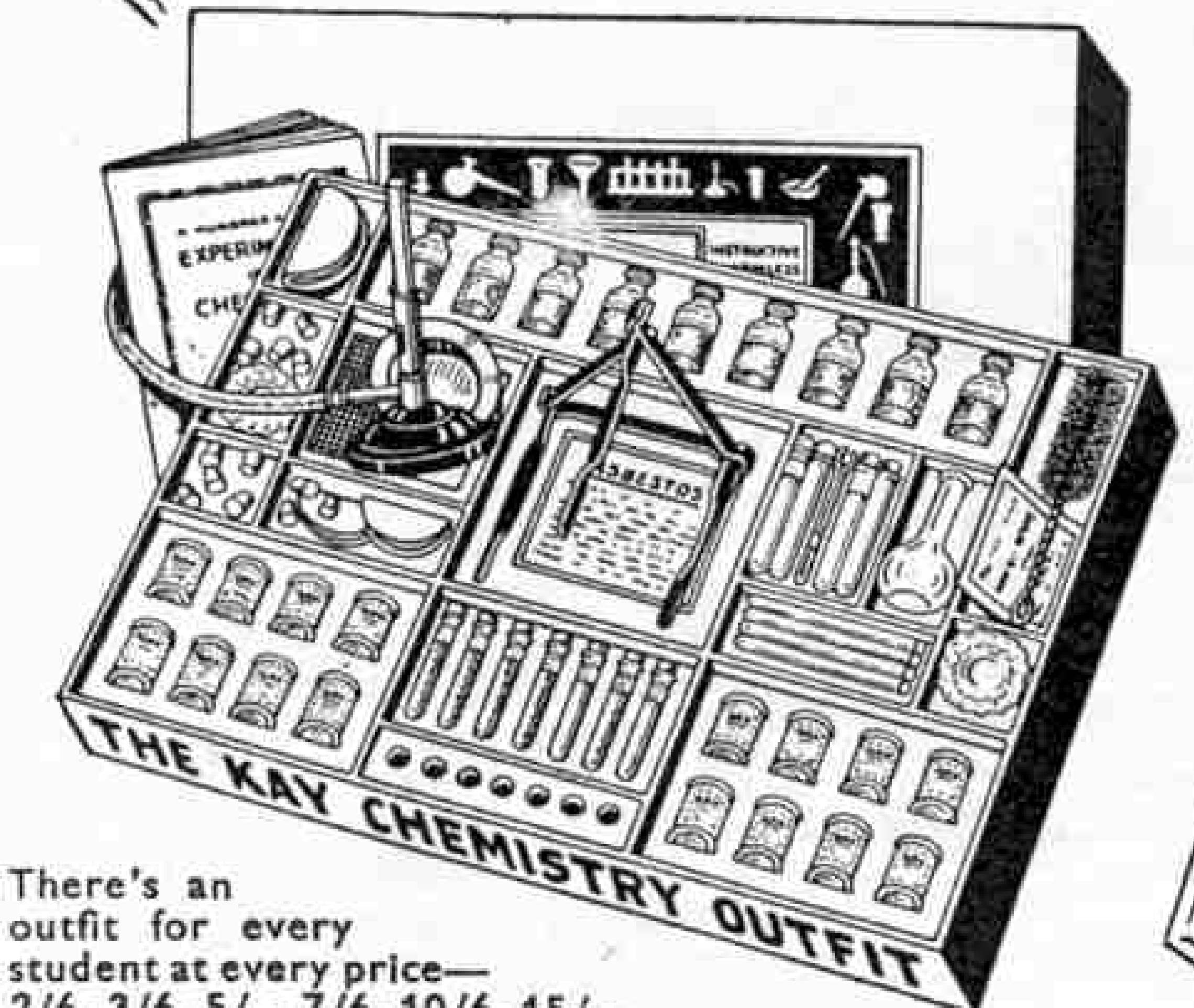
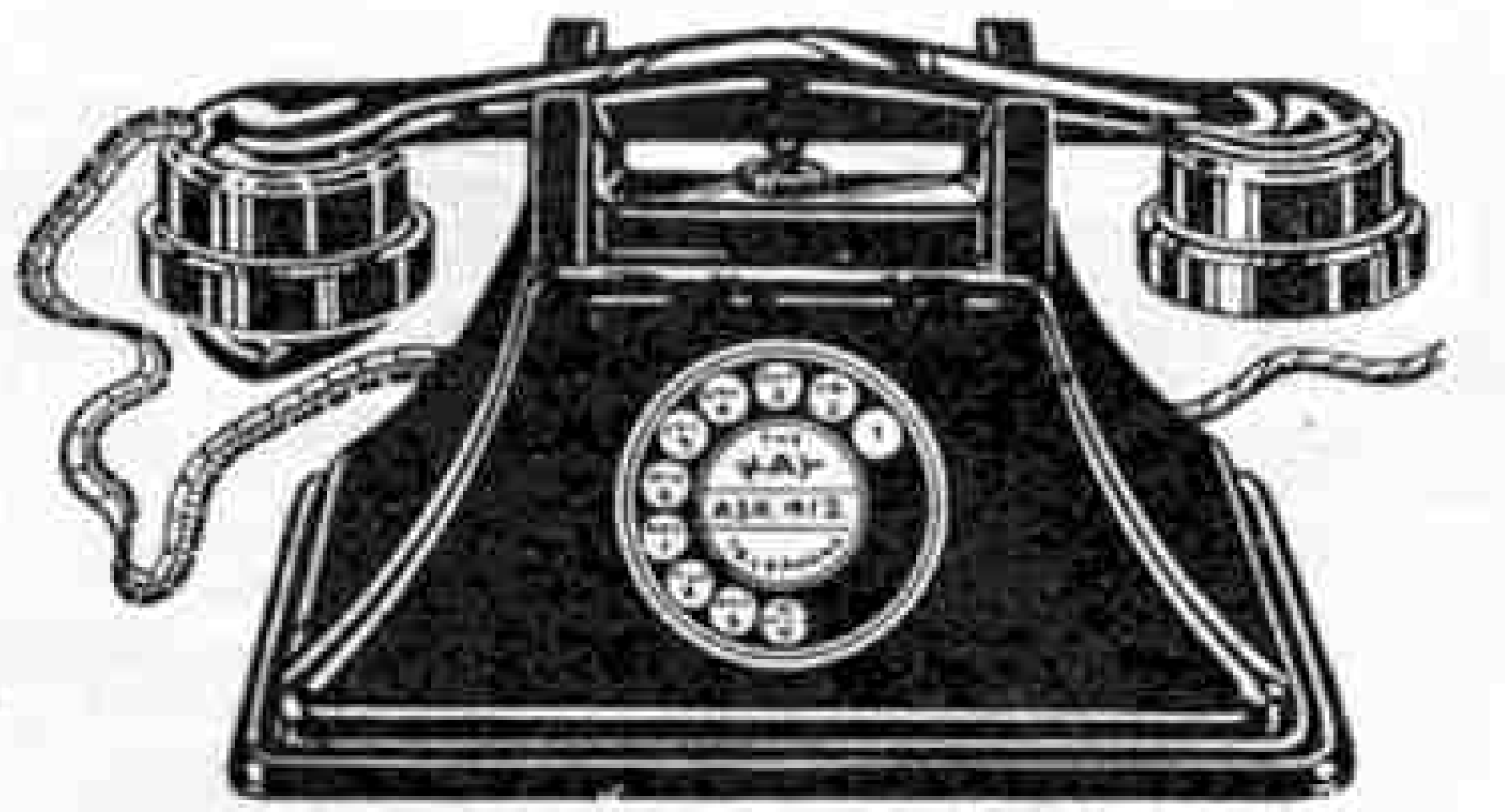
FOR THE BOY WHO WILL HAVE THE BEST—

KAY **KAY** **KAY**

Real laboratories containing all the apparatus and chemicals to perform hundreds of fascinating yet harmless experiments. Each outfit is complete in itself—the pride and joy of every lucky owner.



There's an outfit for every student at every price—2/6, 3/6, 5/-, 7/6, 10/6, 15/-, 21/-, 35/-, 63/- and 105/- each, all containing Bunsen Burners, an excellent assortment of chemicals and apparatus, and full instructions. The set illustrated is 10/6.



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Complete electrical workshops providing many hours of interest and amusement. There is no difficult construction, all the various parts being complete electrical units in perfect working order.

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Obtainable from all leading Stores, Toyshops and Sports Shops. If you have any difficulty, please send direct to the manufacturers:

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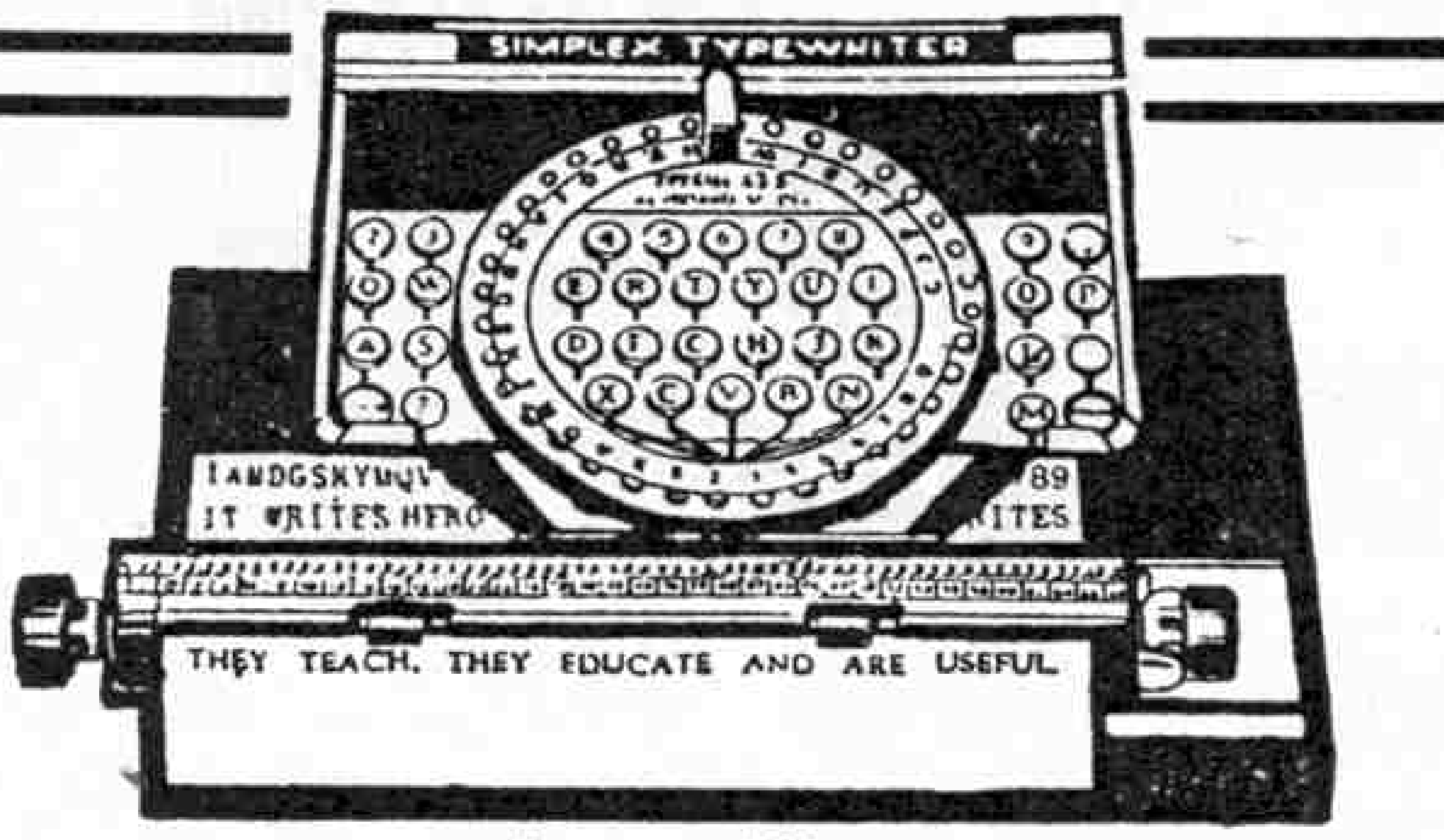
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IT WRITES HERE
THEY TEACH, THEY EDUCATE AND ARE USEFUL

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a b c d e f g h i j k l m n o
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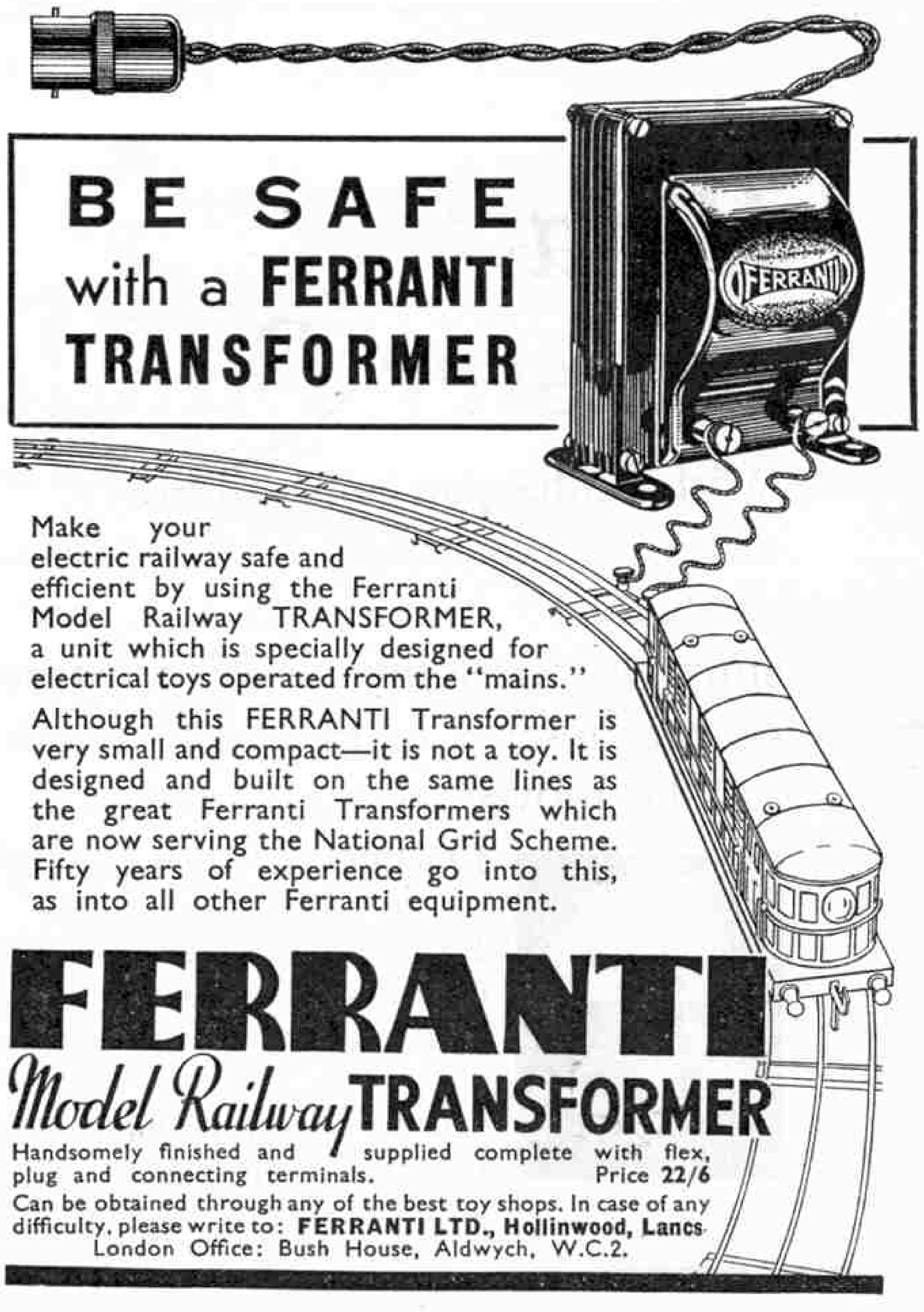

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Make your electric railway safe and efficient by using the Ferranti Model Railway TRANSFORMER, a unit which is specially designed for electrical toys operated from the "mains."

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Dapadant, the new dart-blowing Game	**6d., 1/-, 2/6**	" " 8d., 1/3 & 3/-

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Wonderful Self-Blowing Silver Soldering & Brazing Gun

12'6

Works on house gas with flexible tube. No bellows required. Gives White heat, 9 in. Flame, with tap, as shown, **12/6**; 8 in. Flame **7/6**; 3 in. to 5 in. Flame **5/-**. Post Free. With this easy Blowpipe or Gas Gun anyone can Silver Solder, Braze, Re-metal Bearings, etc., do Tinning, Pipe Work, Plumbing, Heat Soldering Irons quickly, and thousands of jobs with this outfit, including Silver Solder, Brazing Wire, Flux, easy instructions. Supplied to H.M. Govt., Rolls-Royce, B.S.A., Underground Railways. The "Motor Cycle" writes: "The **'BLO-IT-HOT'** certainly fulfils maker's claims." Send now. It earns money. British. List Free.

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Here is a new and interesting booklet produced in answer to the popular demand of Hornby Railway enthusiasts. It contains a wide selection of attractive rail formations, varying from quite simple layouts to more ambitious designs with double track. The best possible uses of Hornby Rails, Points and Crossings are clearly demonstrated.

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HORNBY SERIES

HORNBY ACCESSORIES

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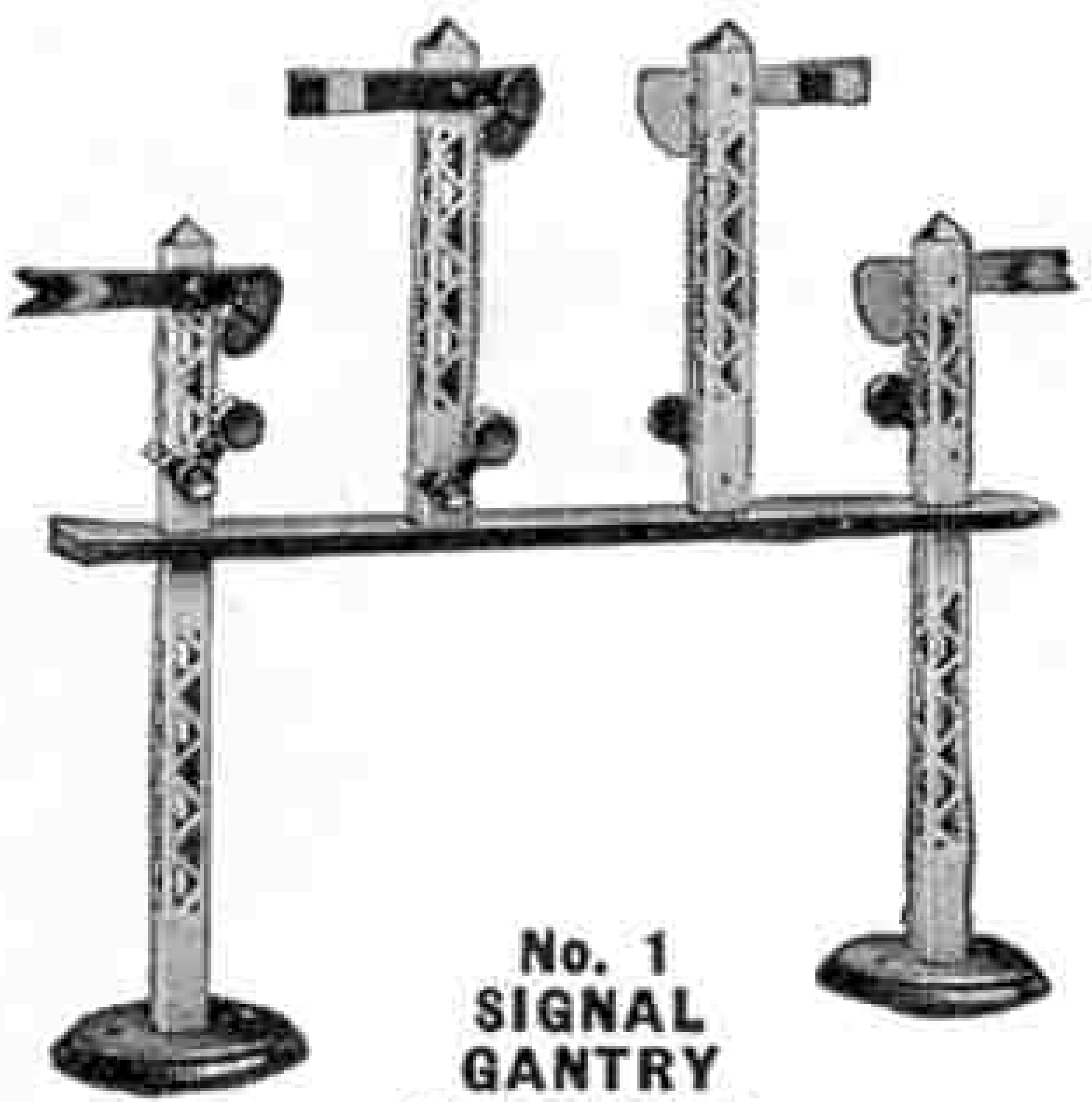
No. O TUNNEL (Straight)
Length 6 in., width 6⅛ in.
Price **1/3**

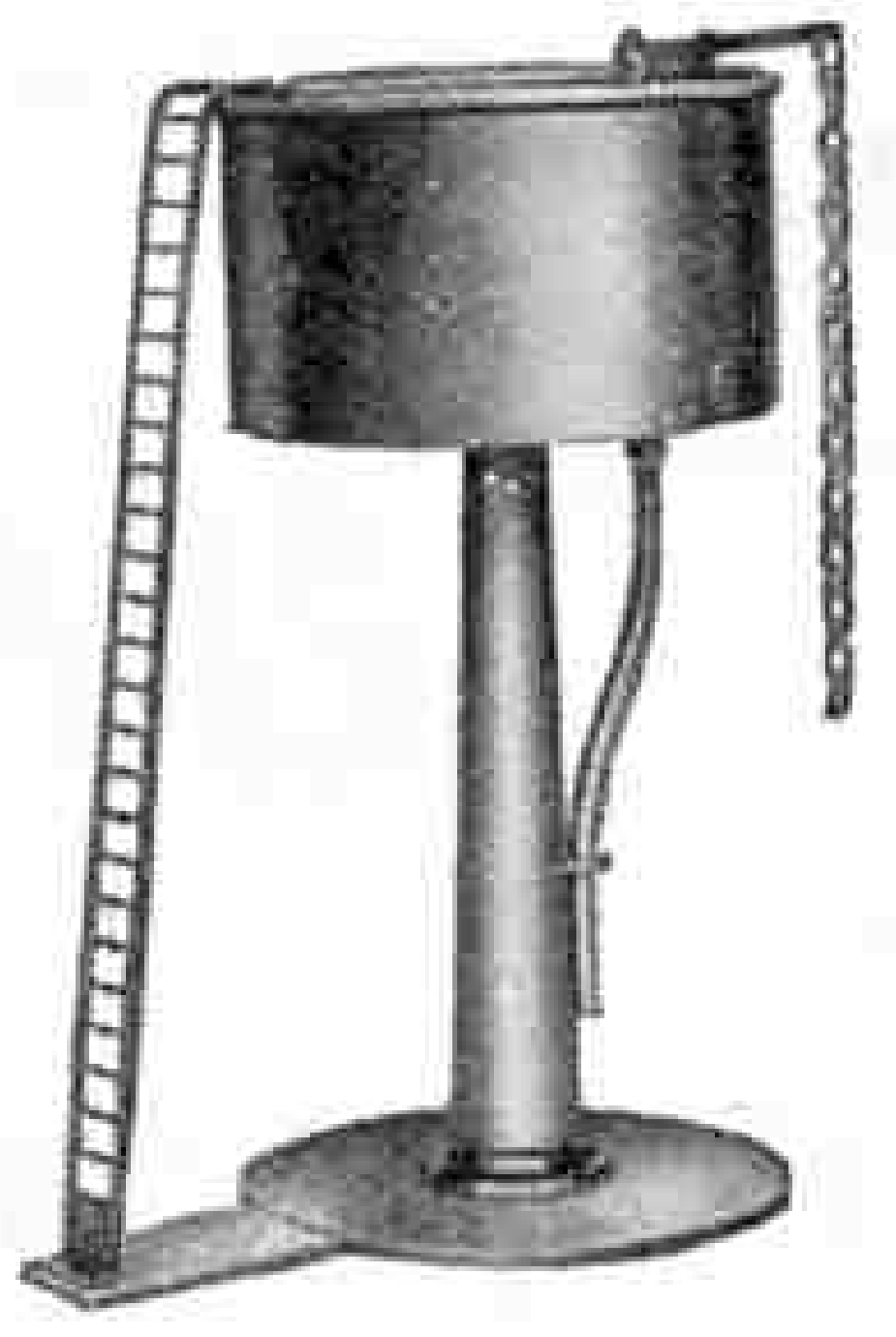
No. 1 TUNNEL (Straight)
Length 7 11/16 in. Width 6¼ in.
(as illustrated). Price **1/9**

No. 2 TUNNEL (Straight)
Length 15⅝ in. Width 9⅜ in.
Price **3/6**

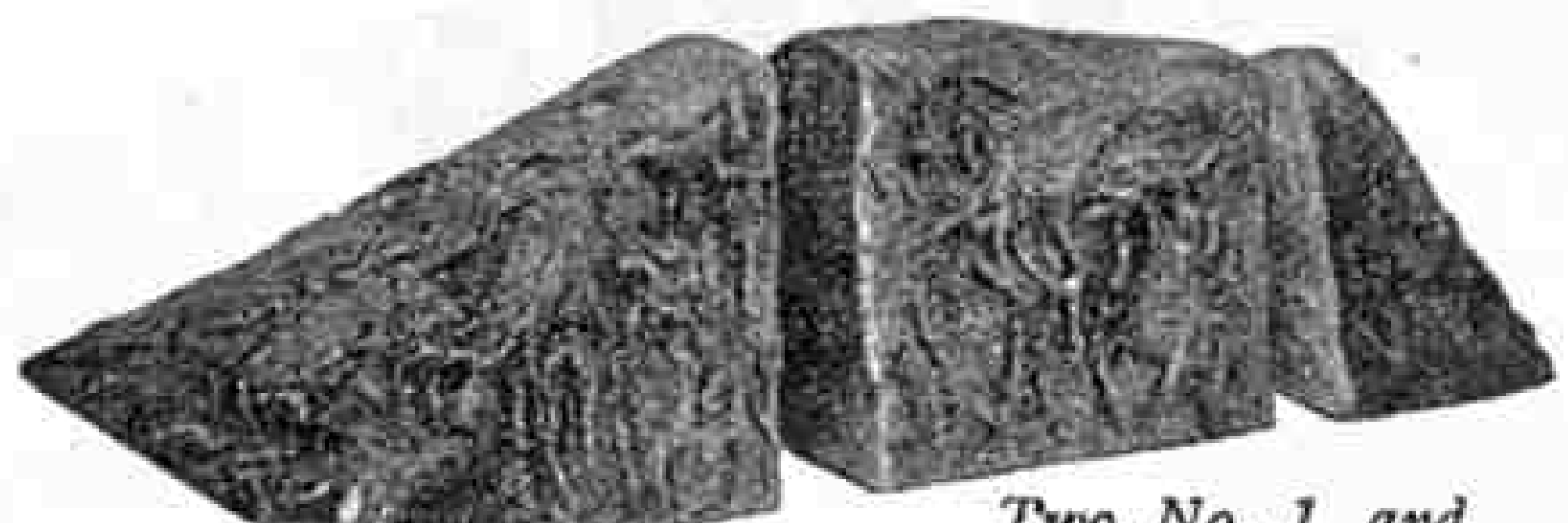
No. 1 WATER TANK
Fitted with flexible tube and valve lever.
Stands 6½ in. high.
Price **3/-**



No. 1 SIGNAL GANTRY
Price **4/11**



No. 2 WATER TANK
Fitted with flexible tube and valve lever.
Stands 8½ in. high.
Price **5/9**



Two No. 1 and one No. 2 Cuttings are illustrated here.

No. 1 CUTTING (END SECTION)
Base measurement: Length 7 11/16 in., width 6 in.
Price, per pair, **3/-**

No. 2 CUTTING (CENTRE SECTION, STRAIGHT)
The addition of these Centre Sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conunction with the End Sections (Cutting No. 1), between which they are fitted.
Base measurement: Length 10½ in., width 6 in.
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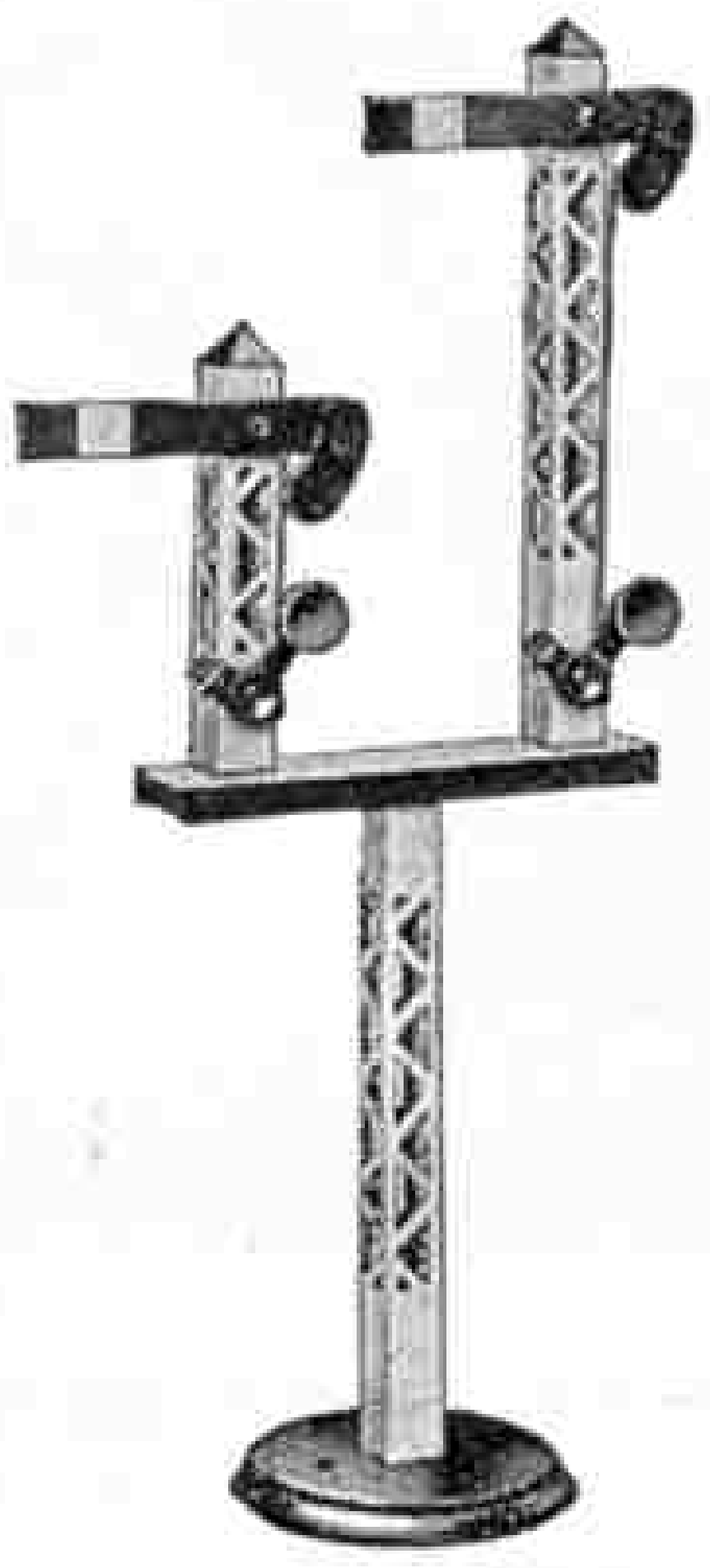
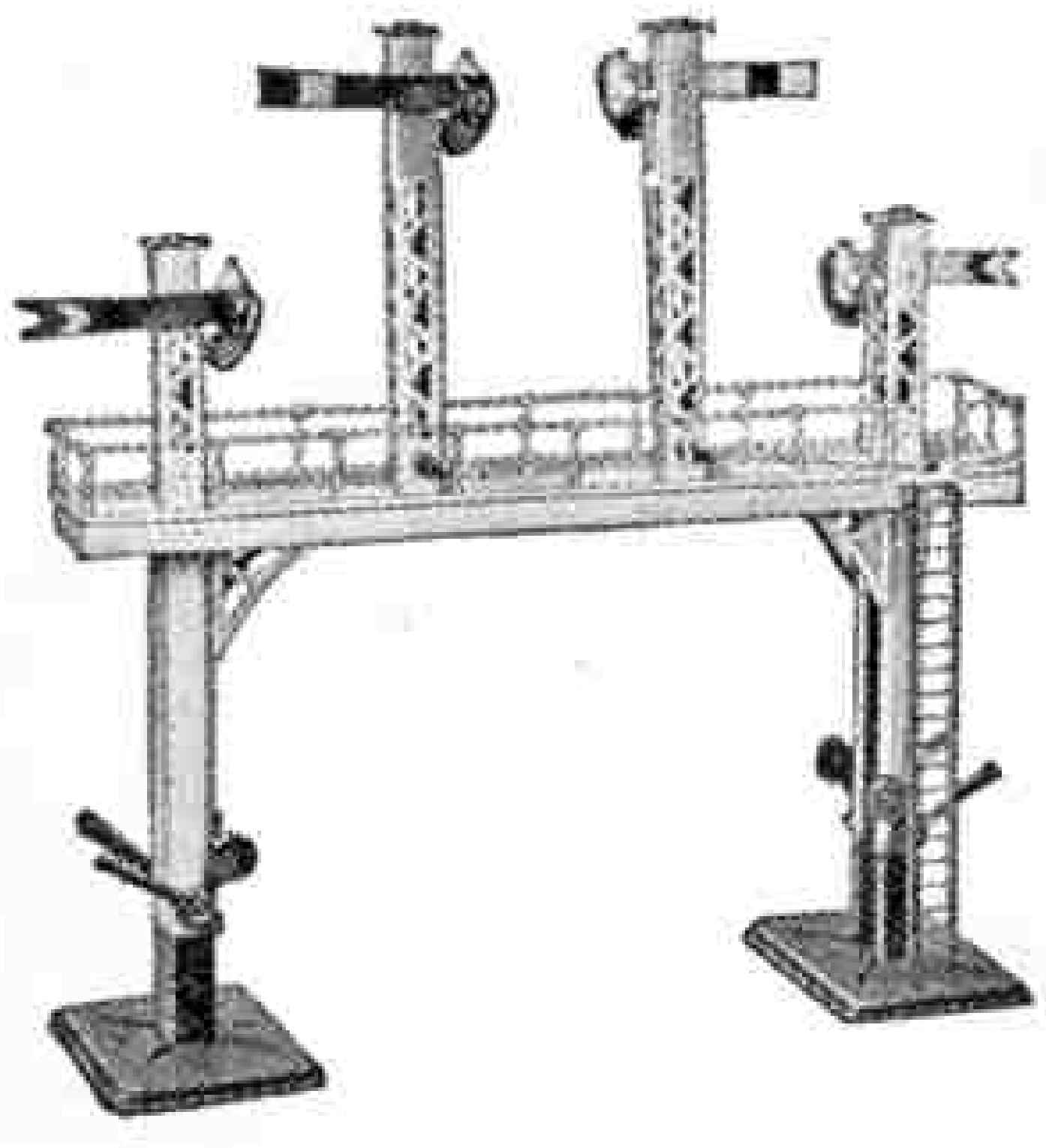
No. 3 CUTTING (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight Centre Section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**

No. 5 TUNNEL (LEFT-HAND, CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks. Base measurement: 15⅞ in. × 14¾ in. Length of track, 17½ in. Price **6/9**

No. 6 TUNNEL (RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement 15⅞ × 14¾ in. Length of track 17½ in. Price **6/9**



No. 1 JUNCTION SIGNAL
Price **2/9**



No. 2 SIGNAL GANTRY
Price **10/-**

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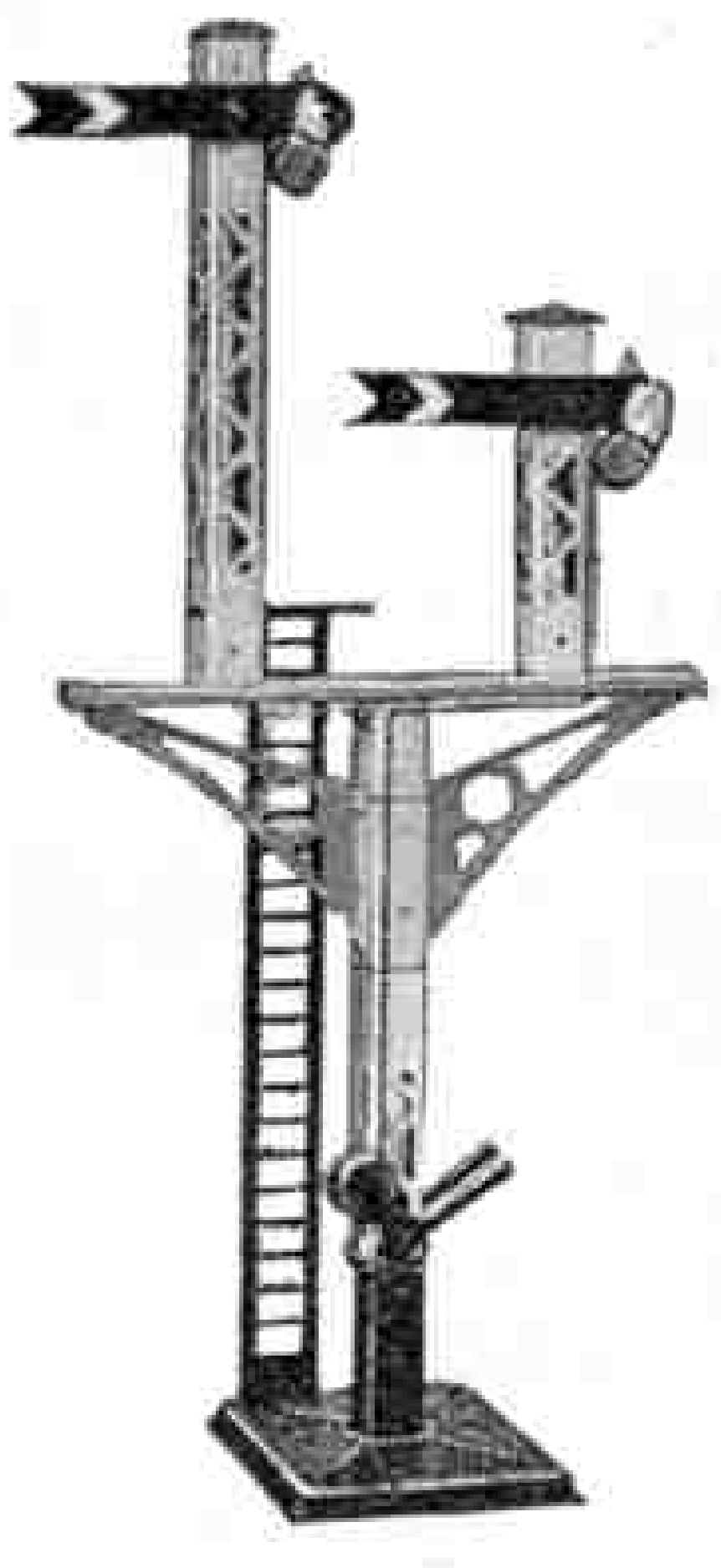
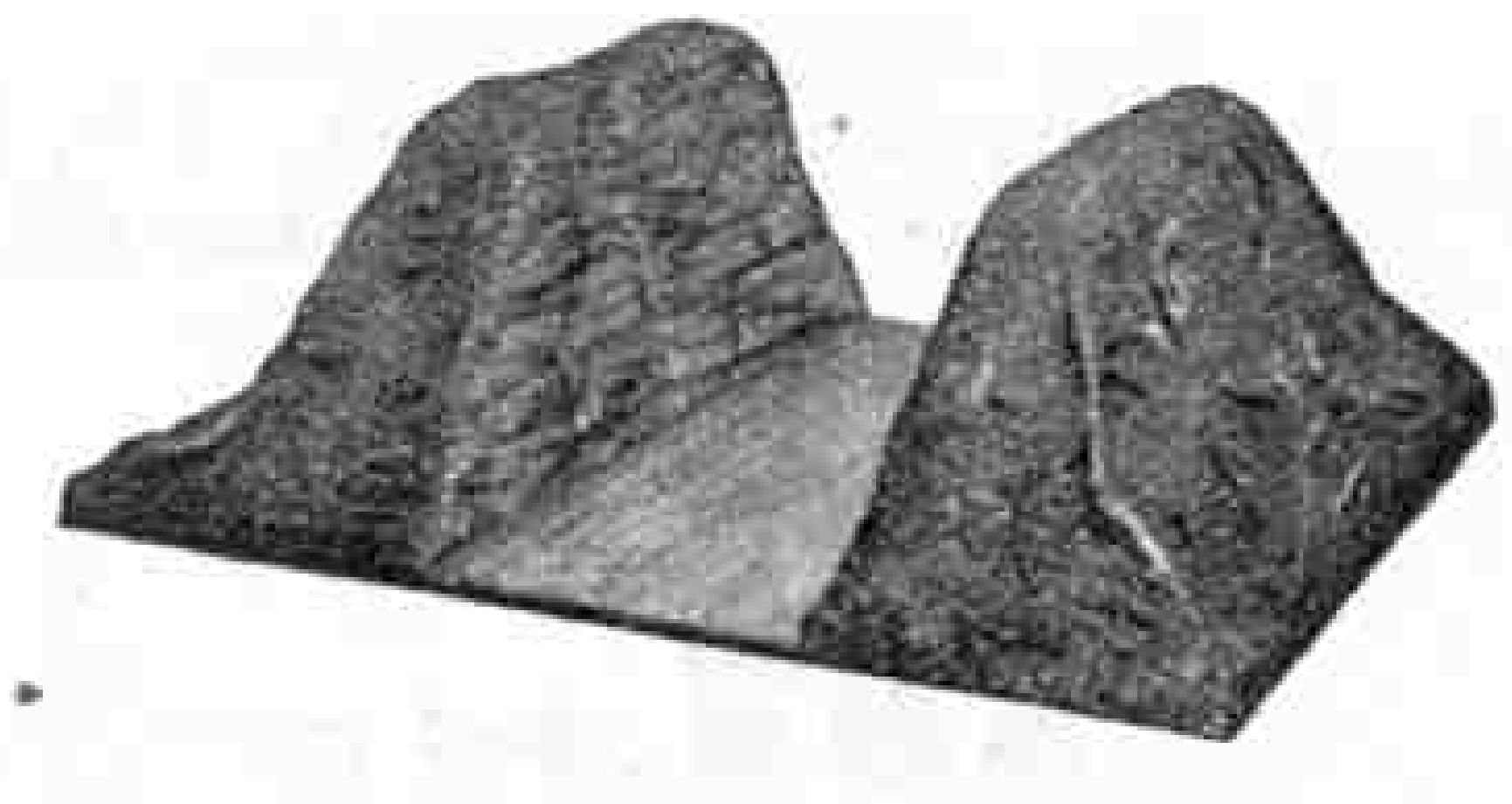
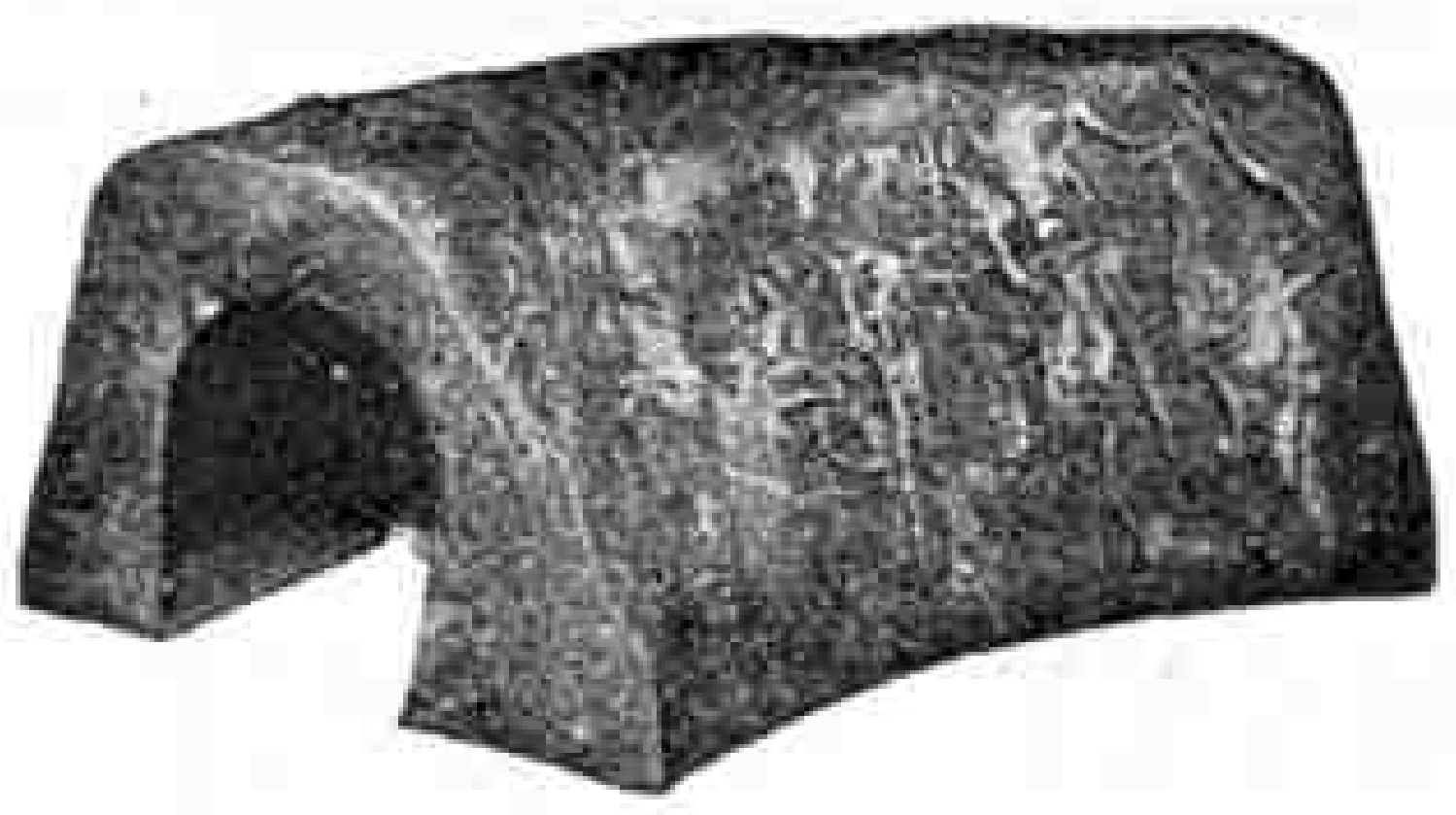


No. 2 JUNCTION SIGNAL
Price **4/9**



No. 4 CUTTING (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid. Base measurement: Length 15⅝ in., width 15 in. Price **6/-**

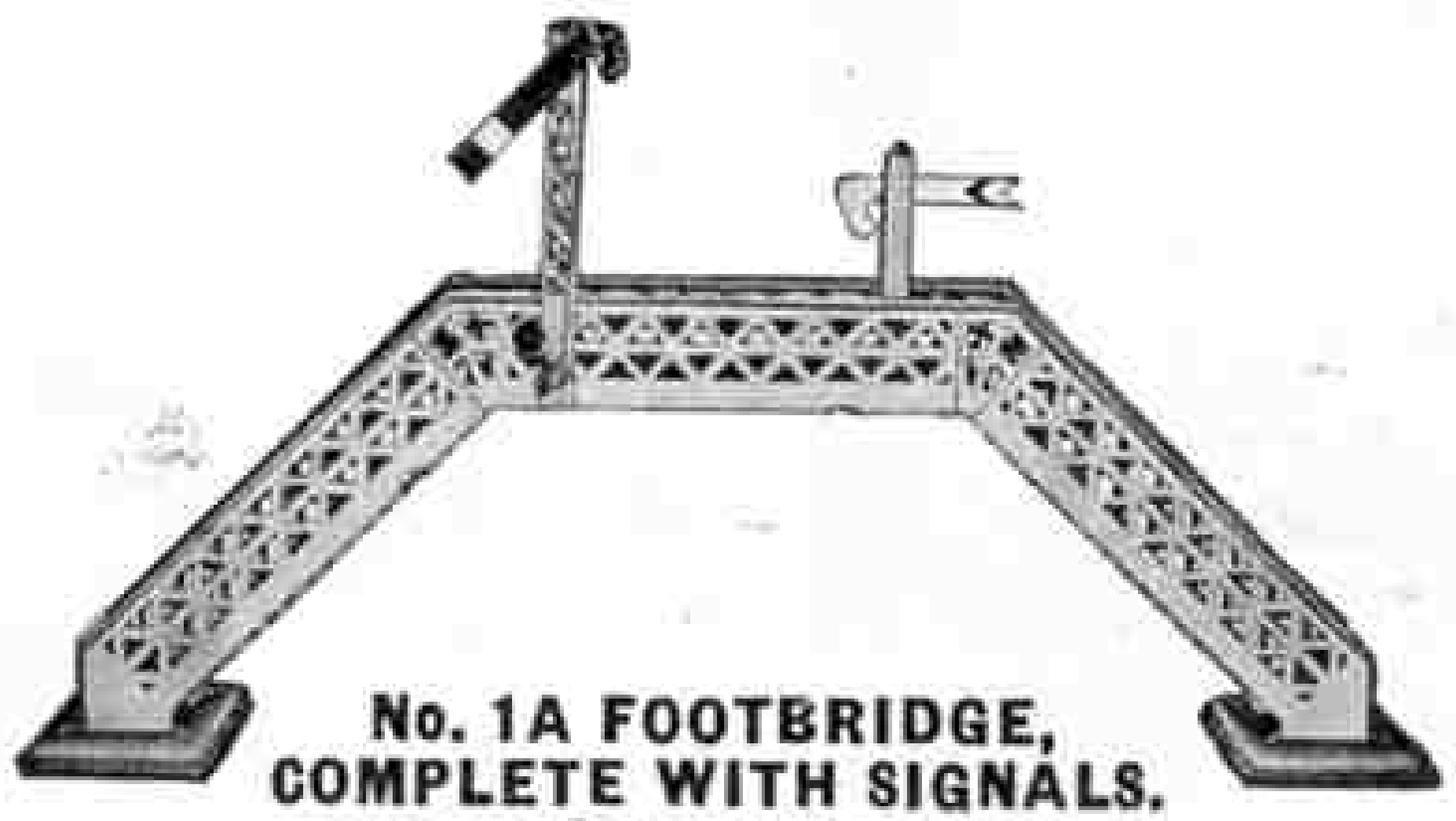


No. 3 TUNNEL (Curved)
Length 13 in. Price **4/-**

No. 4 TUNNEL (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **4/9**

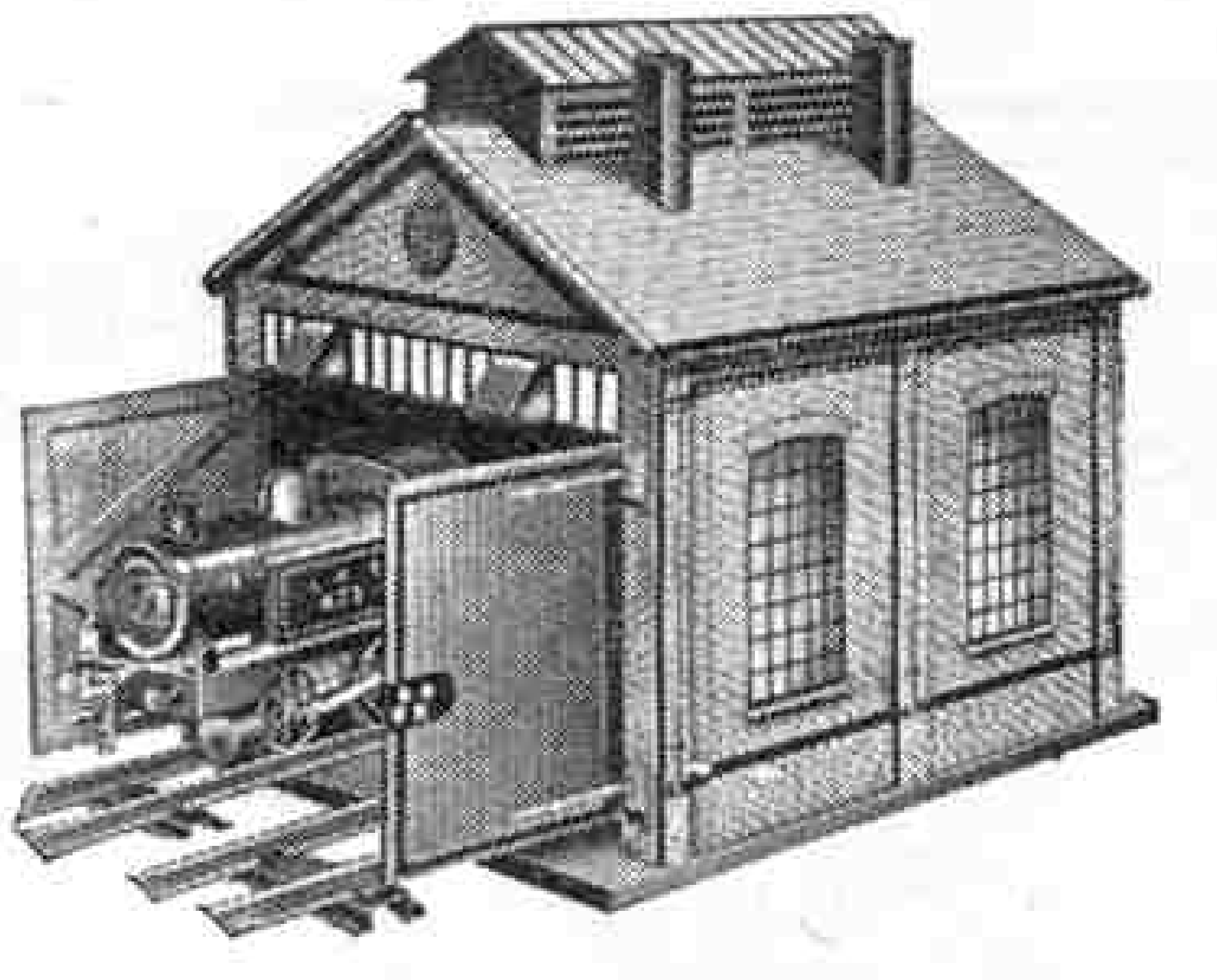
No. 1 SIGNAL CABIN
Price **2/6**

No. 2 SIGNAL CABIN
(illustrated)
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired.
Price **3/9**



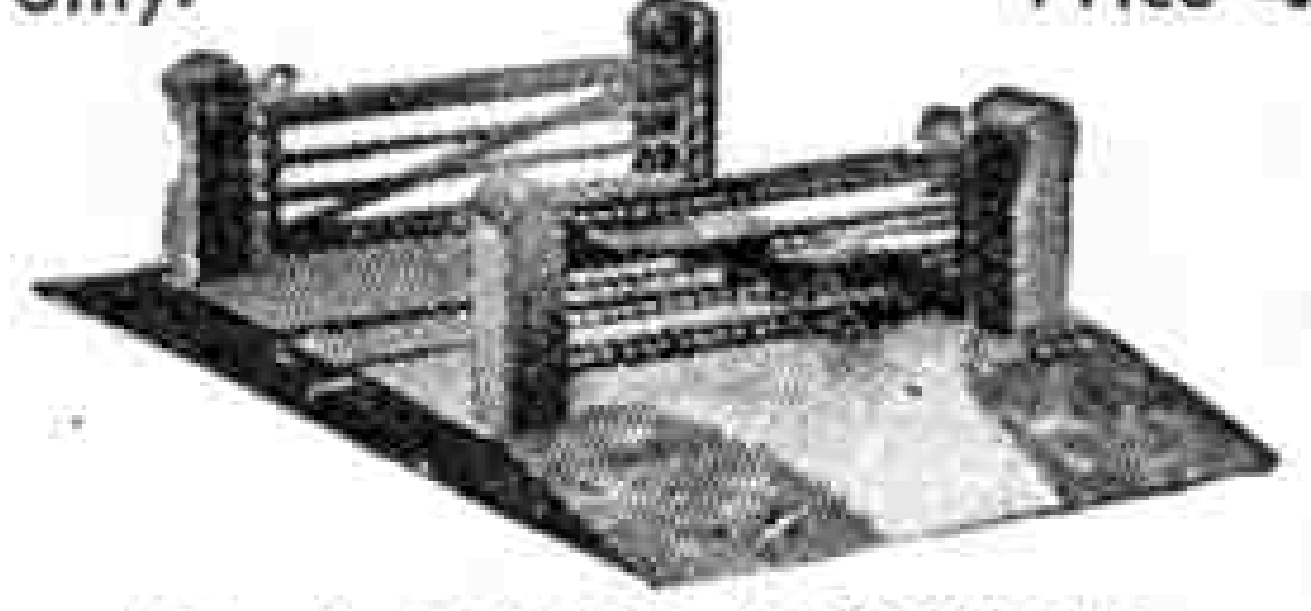
No. 1A FOOTBRIDGE, COMPLETE WITH SIGNALS.
Price **4/6**

No. 1 FOOTBRIDGE WITHOUT SIGNALS Price **2/11**



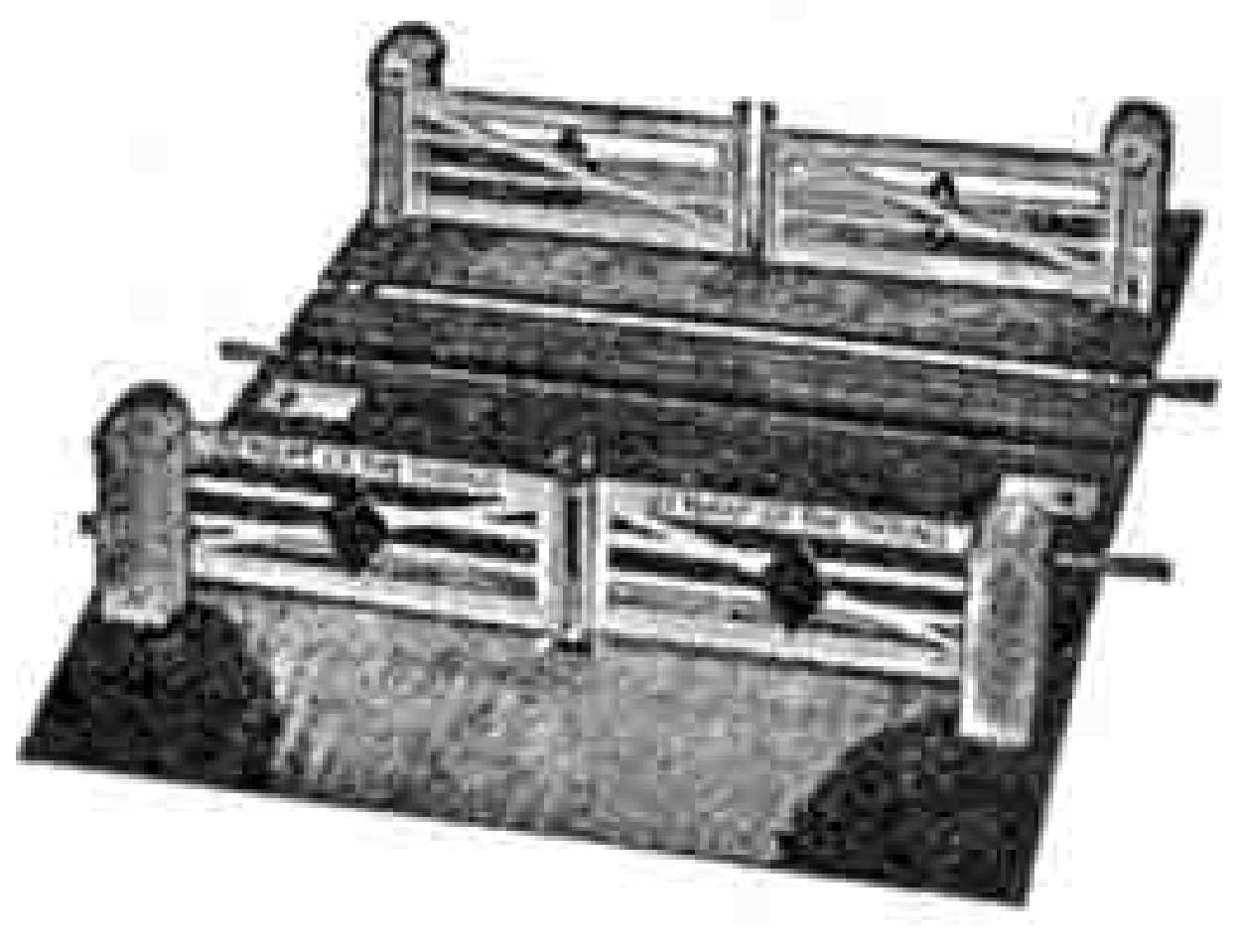
No. 1 ENGINE SHED (illustrated)
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¾ in. ... Price **15/-**

No. 2 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 17½ in. ... Price **22/6**



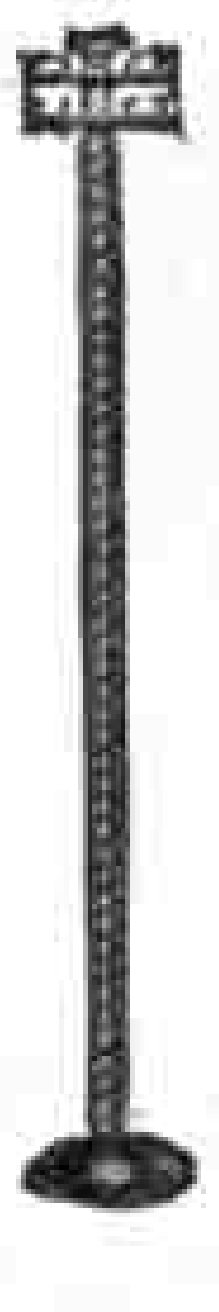
No. 1 LEVEL CROSSING
Suitable for a single track only and has Gauge O rails in position.
Price **2/11**

SHUNTER'S POLE
Price **2**d. each

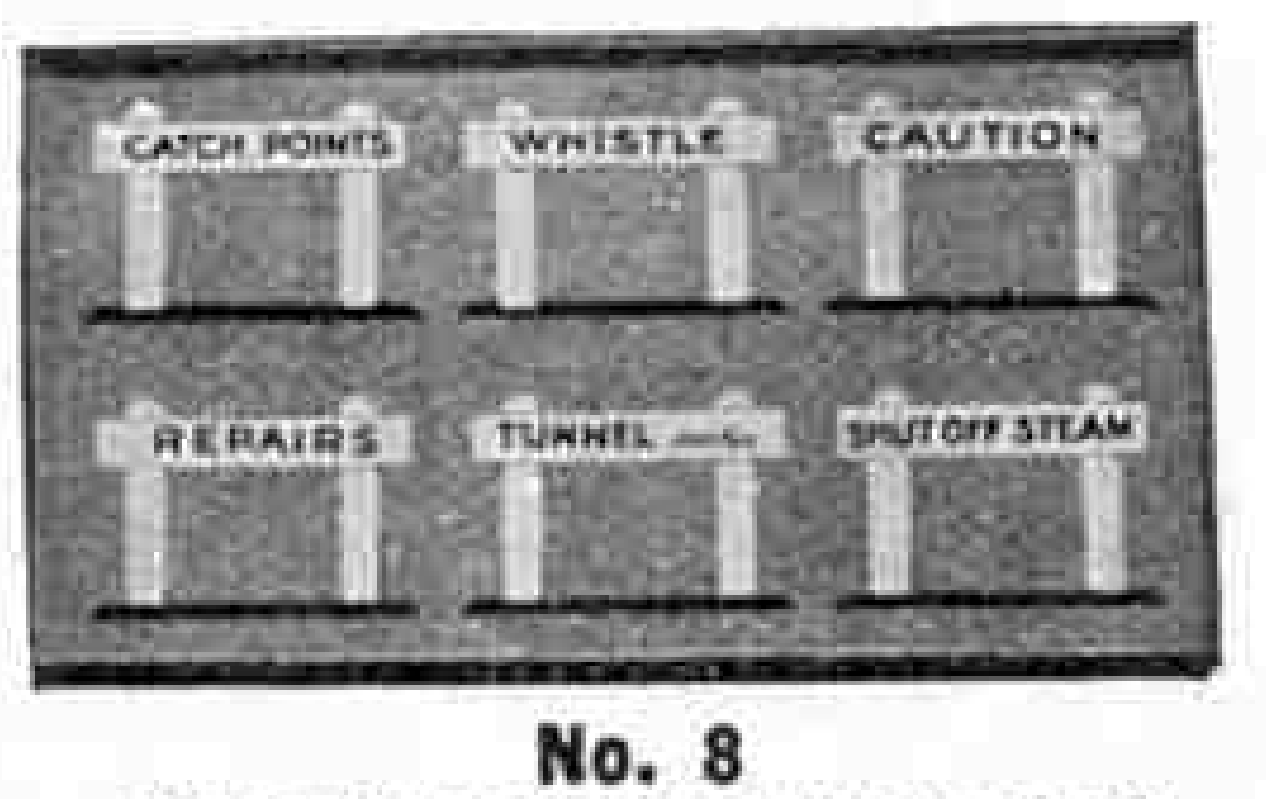


No. 2 LEVEL CROSSING
Measures 13½x10½ in., with two tracks of gauge O rails in position. Price **5/6**

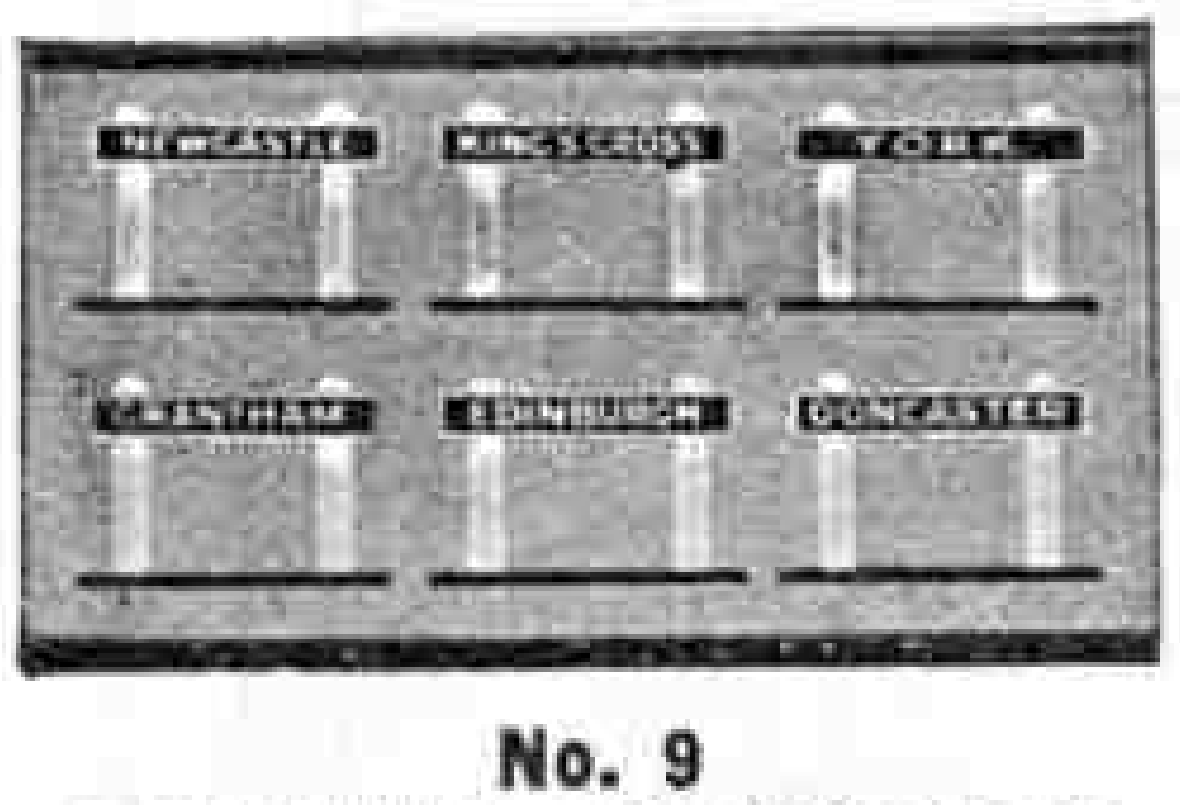
No. E2 LEVEL CROSSING (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks. Price **7/6**



M TELEGRAPH POLE No. 2
Price
4d. each

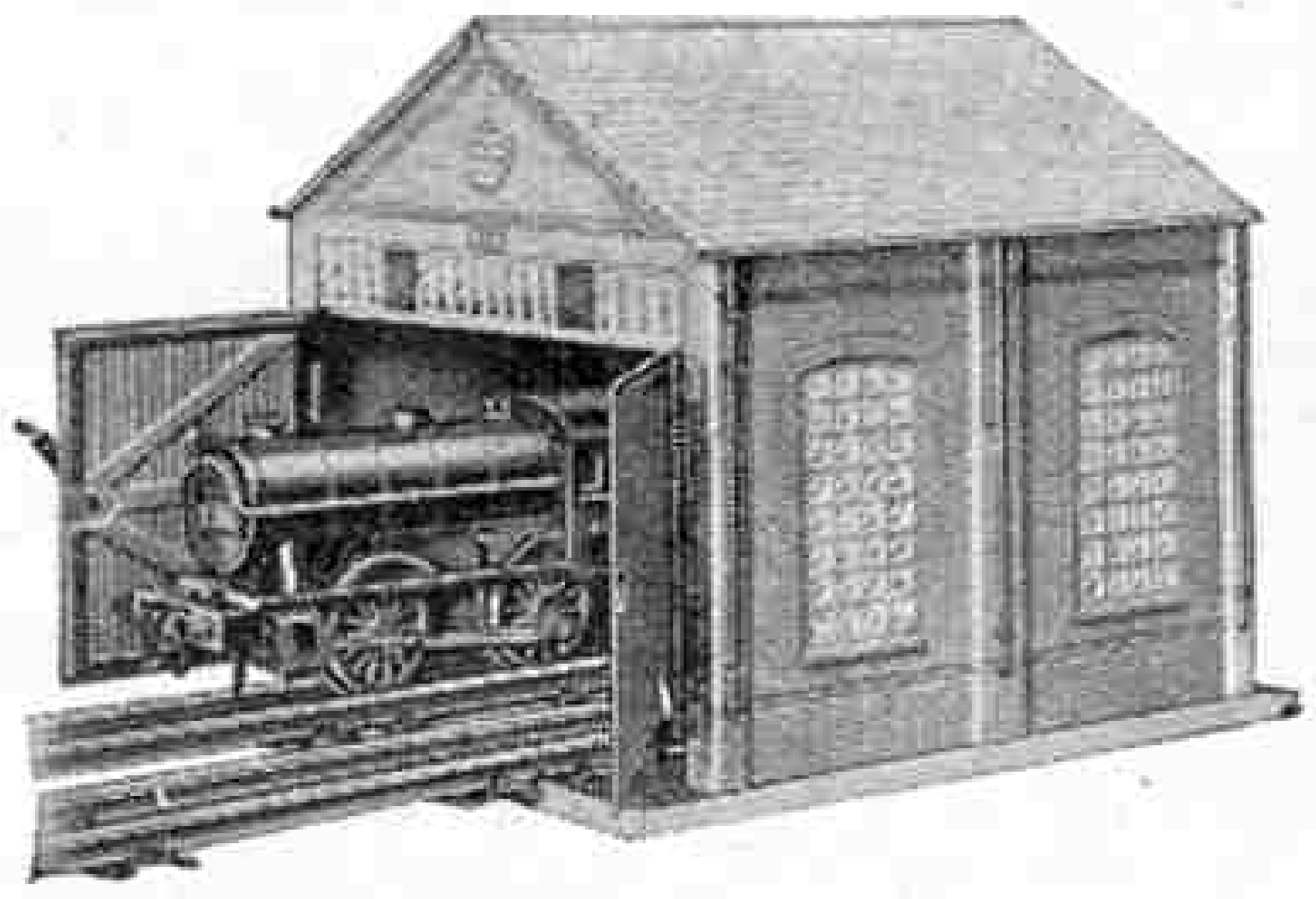


No. 8 RAILWAY ACCESSORIES
Notice Boards ... Price **1/9**



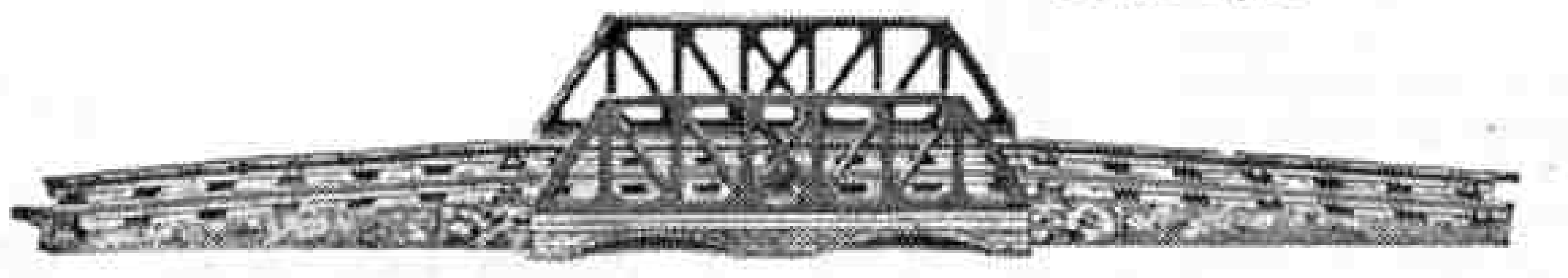
No. 9 RAILWAY ACCESSORIES
Station Name Boards.
Price **1/9**

TELEGRAPH POLE
Price, per pair, **3/6**



No. 1A ENGINE SHED (illustrated)
This Shed is of the same dimensions as the No. 1 Shed described above, but is of simpler design, and has doors at one end only ... ... Price **10/6**

No. 2A ENGINE SHED
This Shed is of the same dimensions as the No. 2 Shed described above, but is of simpler design ... ... Price **17/6**



VIADUCT. Price **6/6** **VIADUCT ELECTRICAL.** Price **7/6**
VIADUCT. Centre Section only. Price **4/-**
VIADUCT (electrical). Centre Section only ... Price **4/6**

Ask your dealer for a complete illustrated price list of Hornby Trains, Rolling Stock and Accessories.

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

TOYS OF QUALITY MADE BY
MECCANO LTD

DINKY BUILDER

A FASCINATING BUILDING HOBBY FOR BOYS AND GIRLS

This is one of the most fascinating building systems ever devised for young children to play with. By means of the beautiful enamelled parts contained in the Outfits, boys or girls can build very real-looking Coaches, Aeroplane Hangars, Garages, Towers, Bridges, Wheel Toys, Windmills—hundreds of toys, each one a real strong plaything.

The Dinky Builder Plates are hinged on all sides, with intervening spaces so that when two are placed side by side the hinged part of one Plate fits into the corresponding space in the other. There are now three Outfits in the series; No. O Outfit is available in bright red and green finish, while No. 1 and No. 2 Outfits can be obtained in bright red and green or in salmon pink and jade green finish.

Manufactured by MECCANO LTD., Binns Road, LIVERPOOL 13

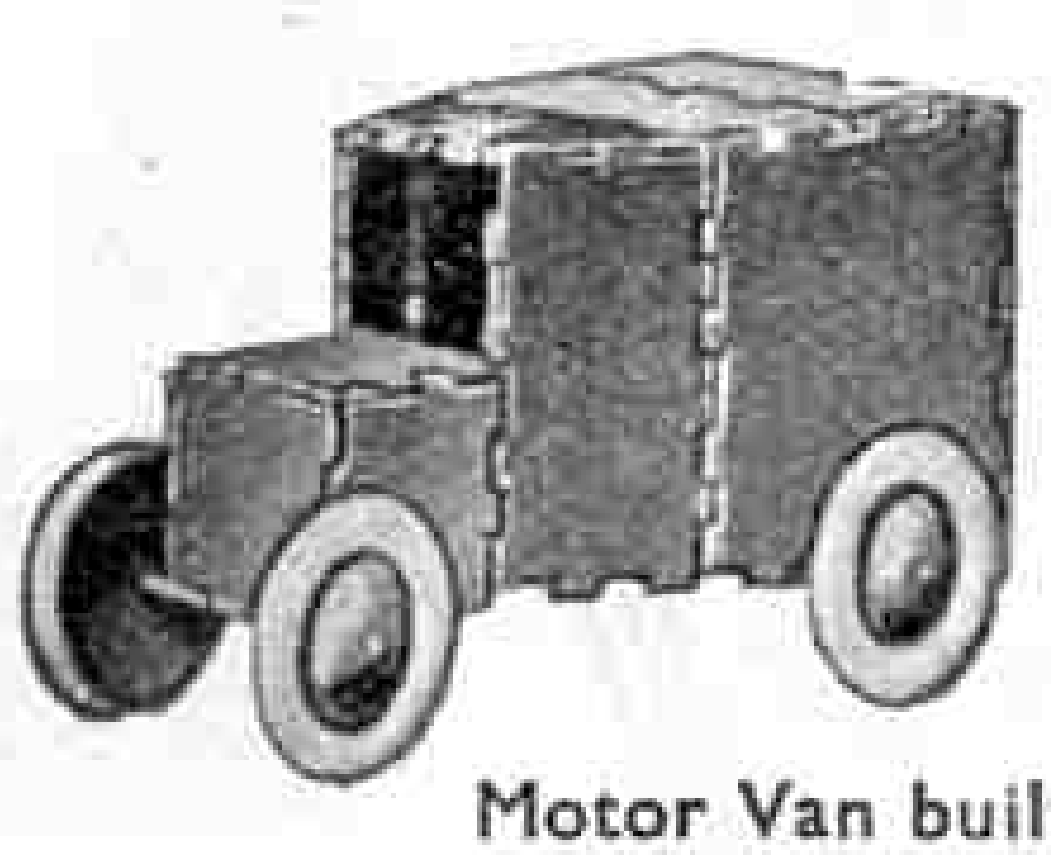
No. 1 Dinky Builder Outfit.

No. O DINKY BUILDER OUTFIT

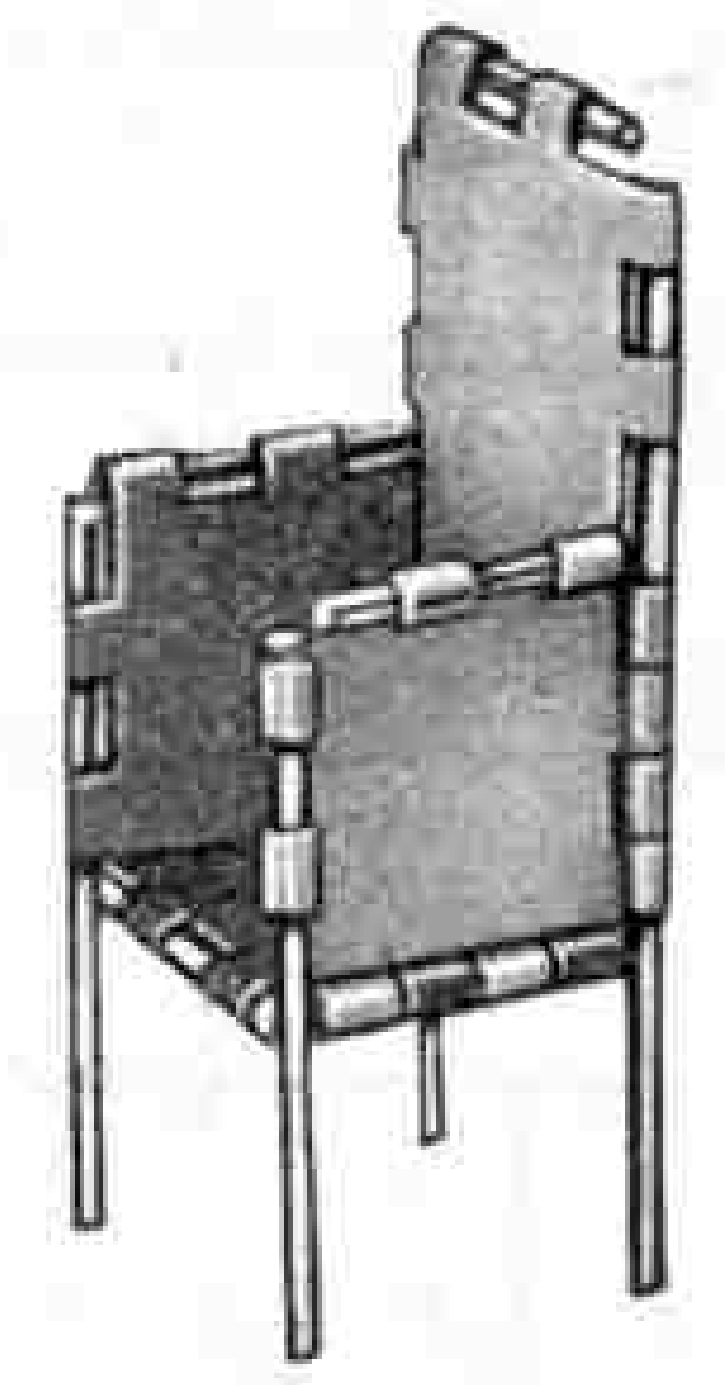
This is an excellent Outfit, containing a good assortment of Dinky Builder parts (including two road wheels), with which a splendid range of models can be built. The Instruction Folder included gives examples of 40 models, but many others of an original character can be constructed by the inventive boy or girl. Price 2/6

No. 1 DINKY BUILDER OUTFIT

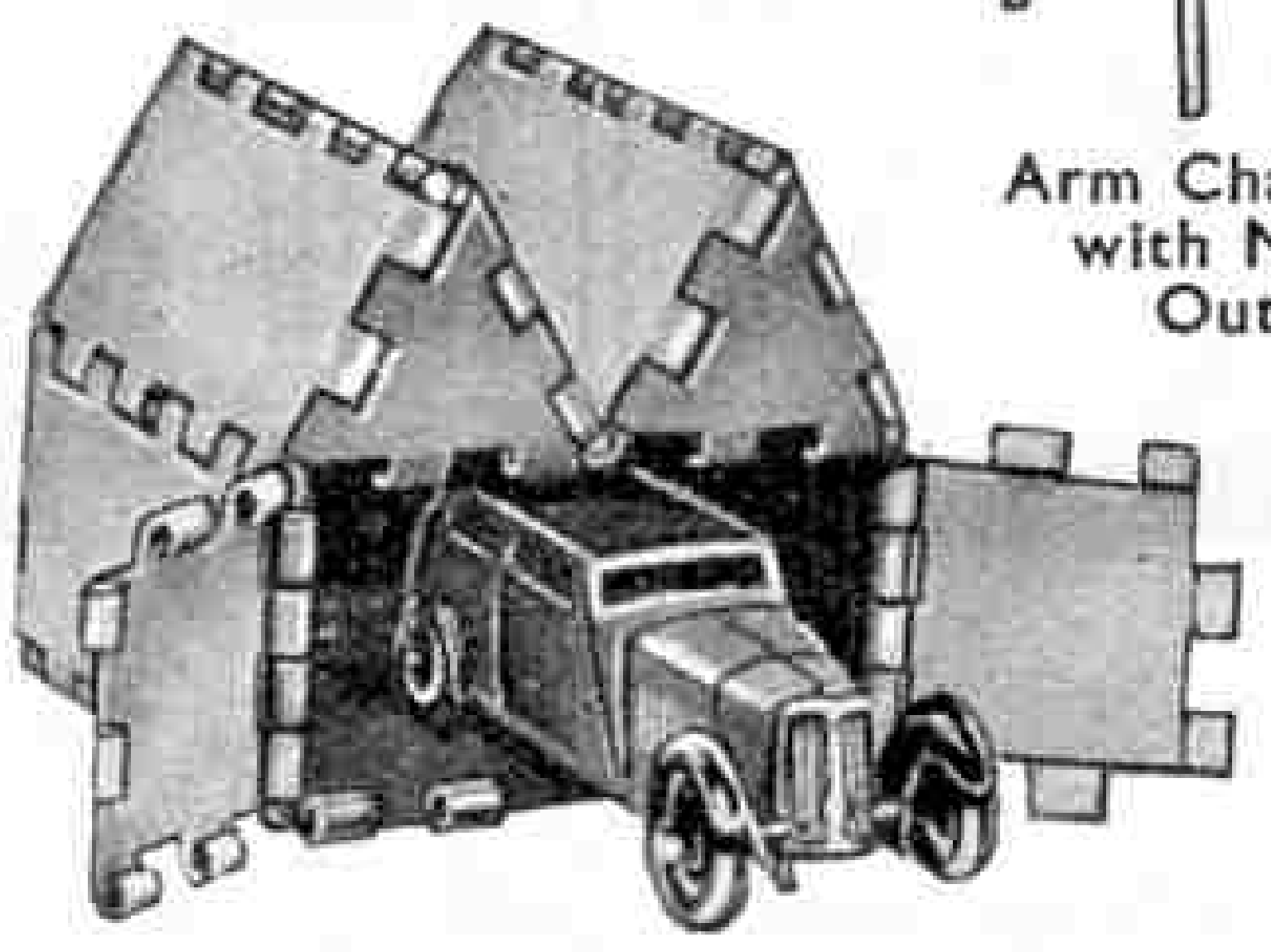
This splendid Outfit contains a varied selection of parts, including two trees on die-cast stands that lend the correct atmosphere to models of farm buildings, churches, etc. A further attraction is a set of four road wheels for constructing miniature wheel toys, many examples of which are illustrated in the Instruction Folder. These instructions show a total of 70 fine models that any boy or girl can build. Price 4/11



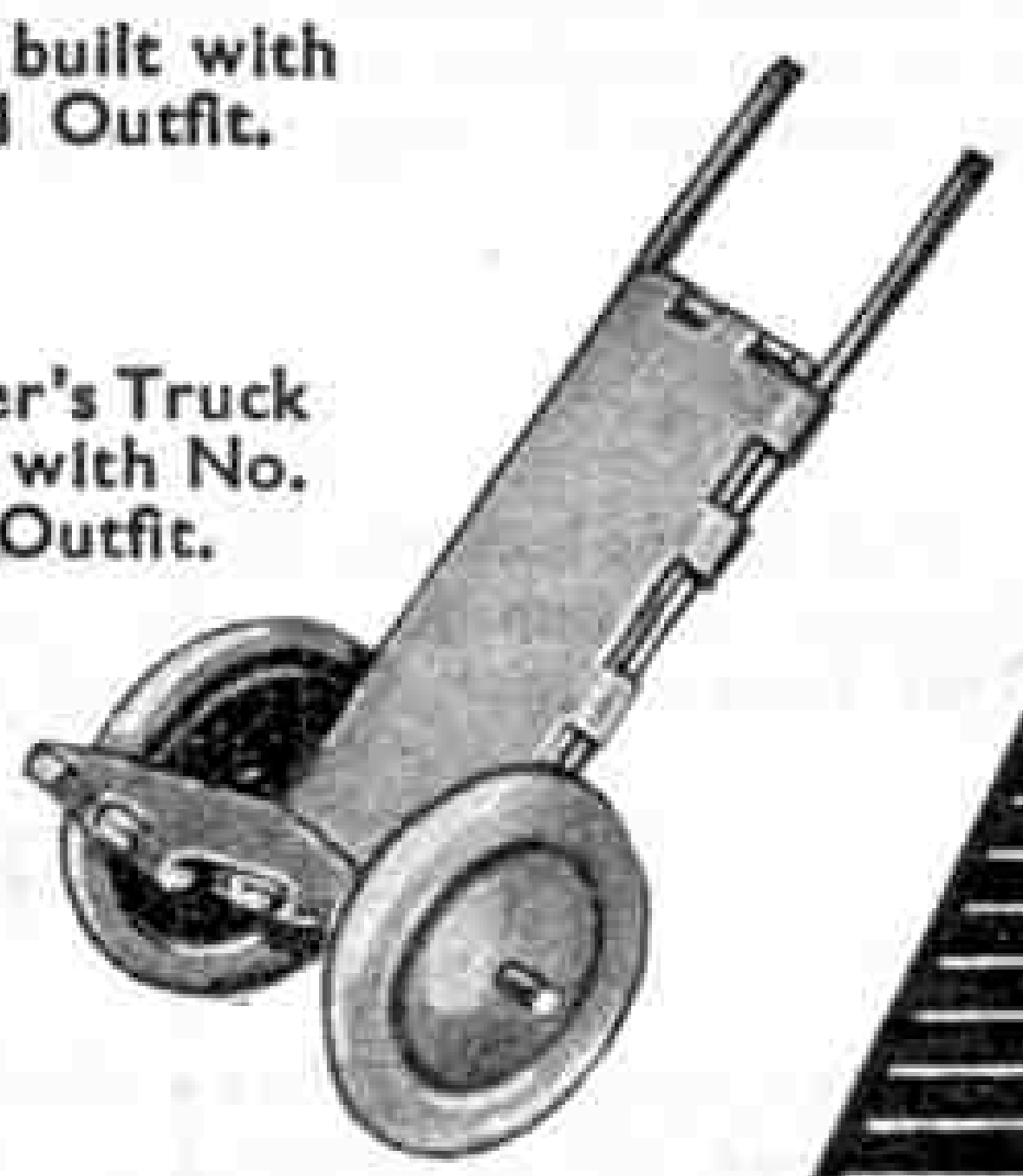
Motor Van built with No. 1 Outfit.



Arm Chair built with No. O Outfit.



Garage built with No. 1 Outfit.



Porter's Truck Built with No. O Outfit.

No. 2 Dinky Builder Outfit.

No. 2 DINKY BUILDER OUTFIT

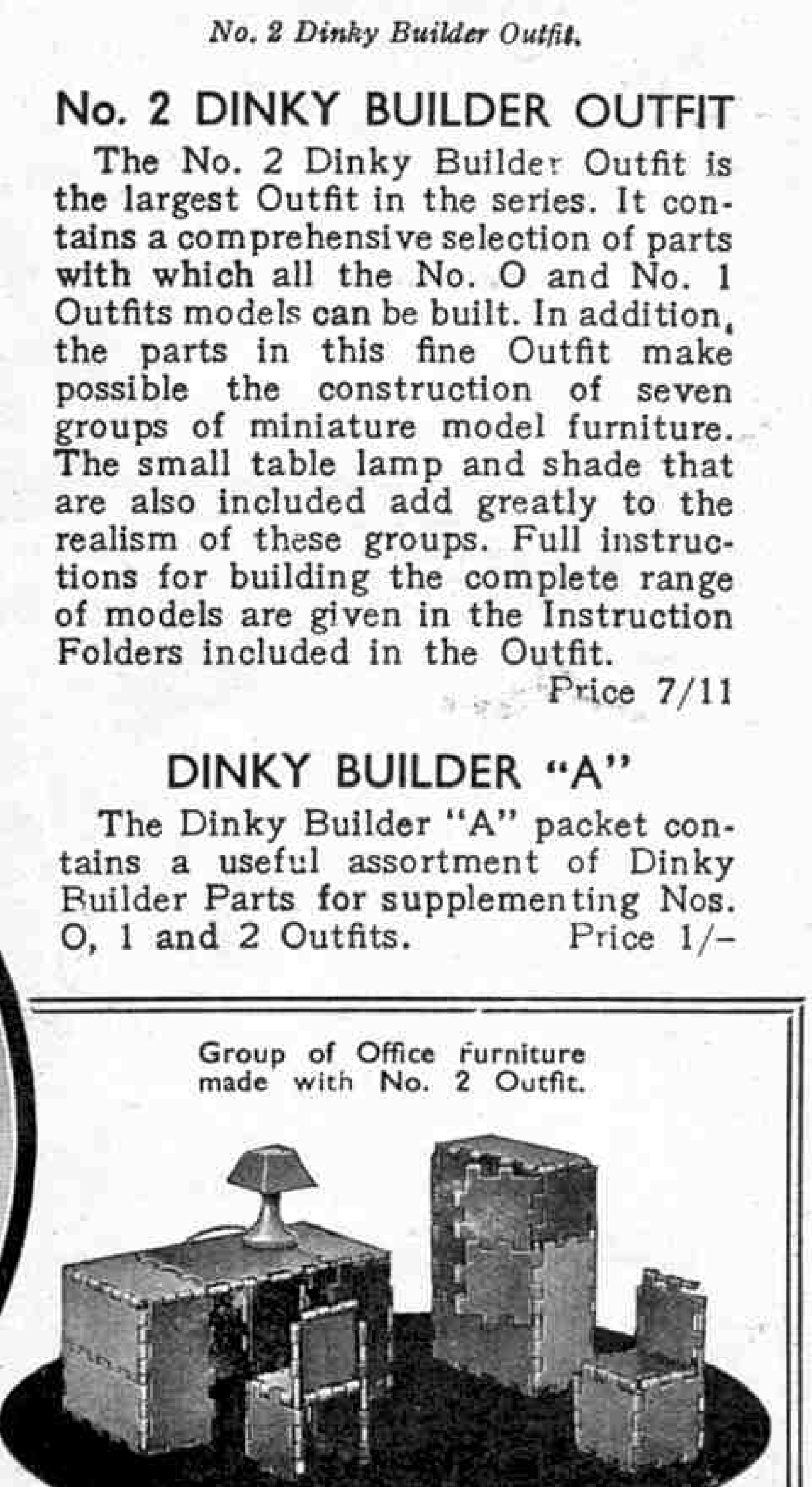
The No. 2 Dinky Builder Outfit is the largest Outfit in the series. It contains a comprehensive selection of parts with which all the No. O and No. 1 Outfits models can be built. In addition, the parts in this fine Outfit make possible the construction of seven groups of miniature model furniture. The small table lamp and shade that are also included add greatly to the realism of these groups. Full instructions for building the complete range of models are given in the Instruction Folders included in the Outfit. Price 7/11

DINKY BUILDER "A"

The Dinky Builder "A" packet contains a useful assortment of Dinky Builder Parts for supplementing Nos. O, 1 and 2 Outfits. Price 1/-

Group of Bedroom Furniture made with No. 2 Outfit.

Group of Office Furniture made with No. 2 Outfit.



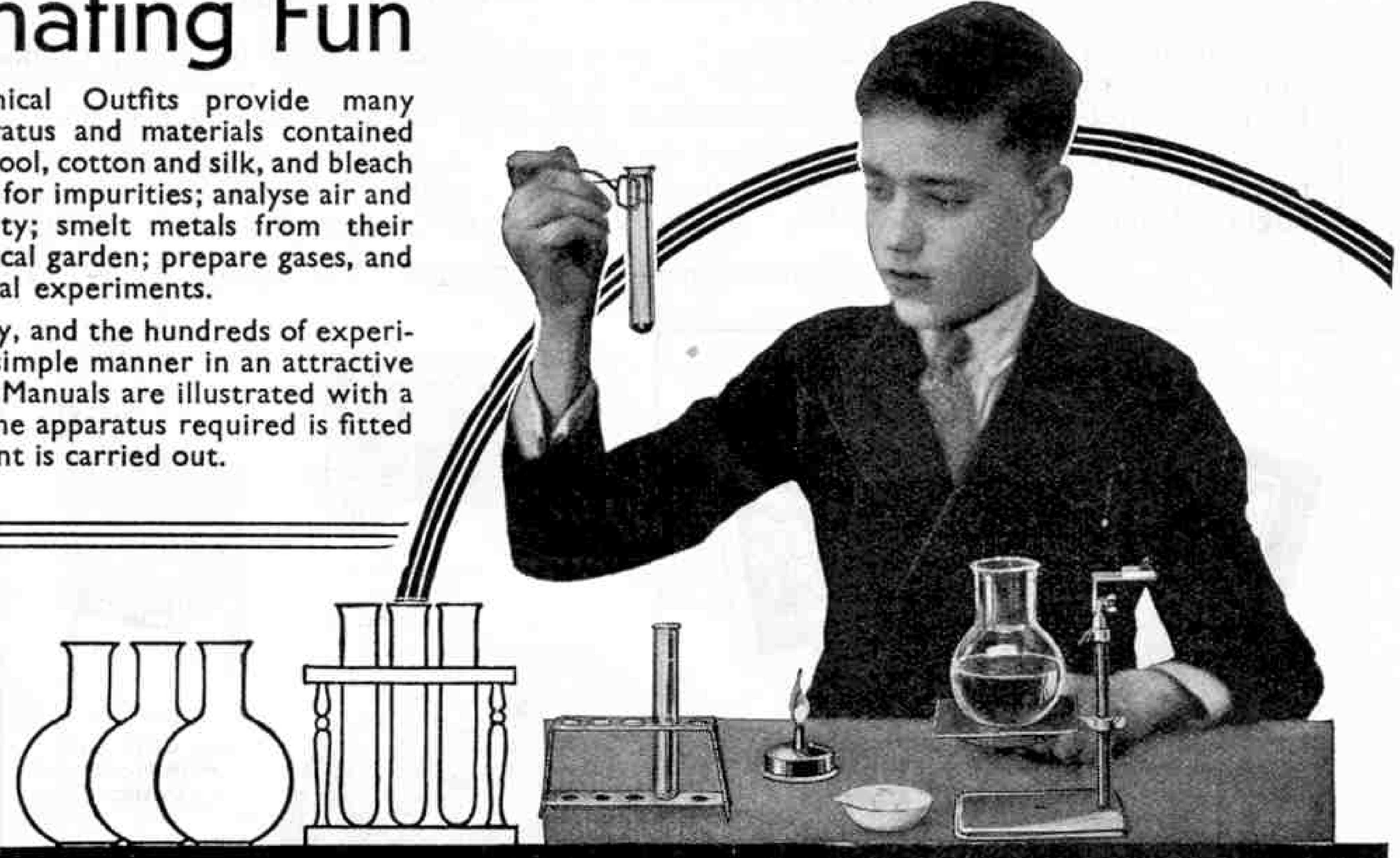
ANOTHER OF MECCANO LTD'S FAMOUS TOYS

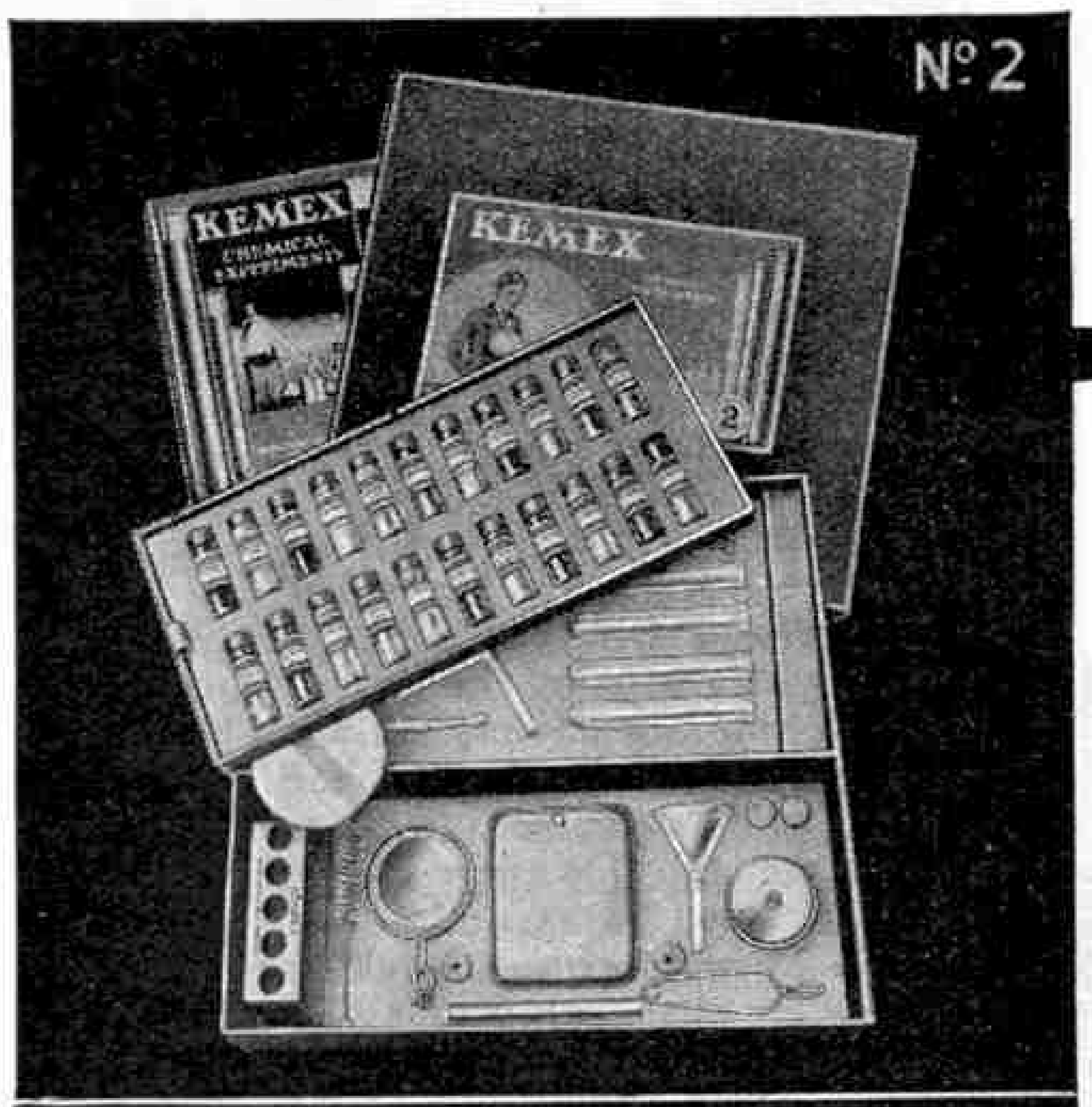
Kemex Chemical Outfits

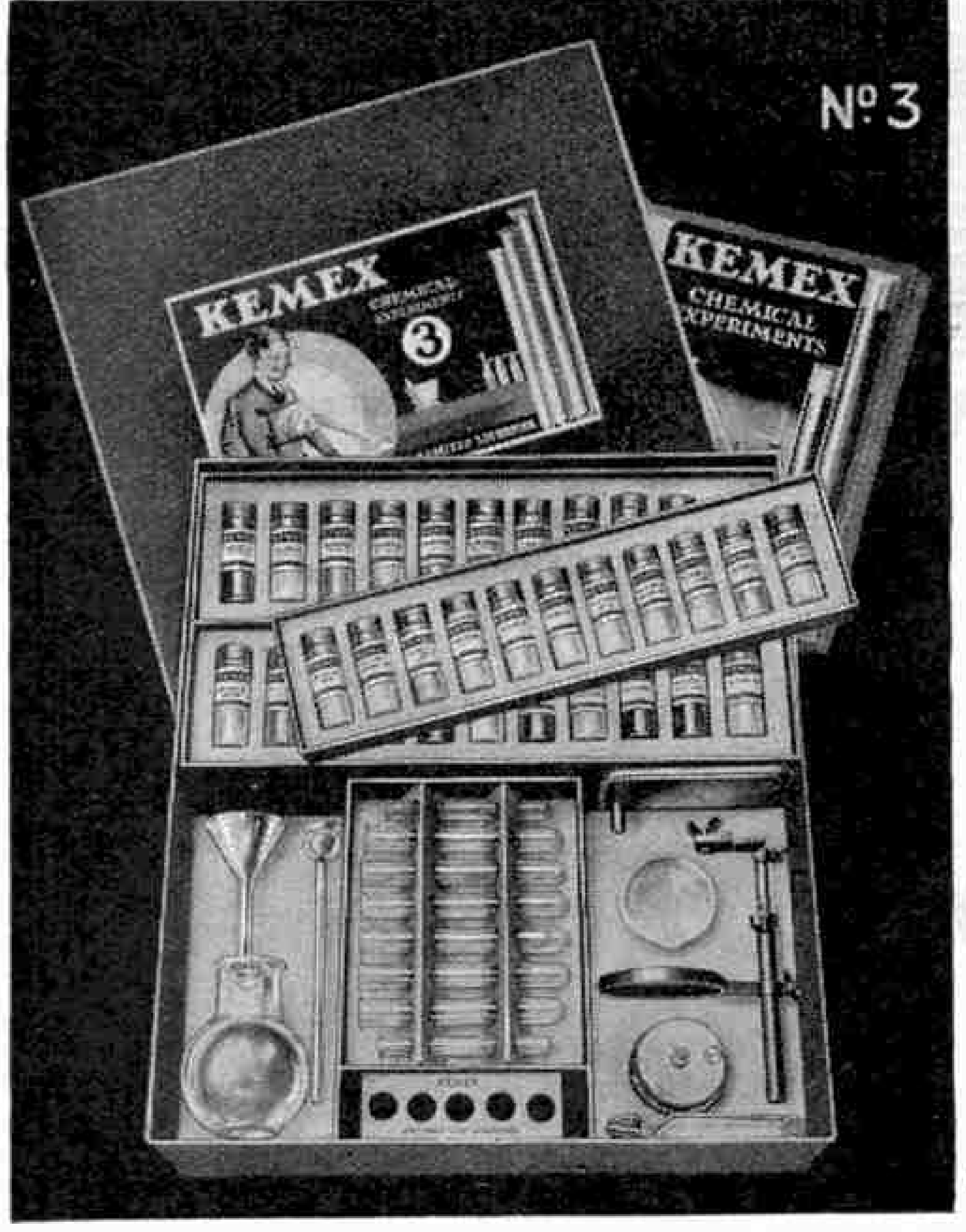
Hours of Fascinating Fun

The contents of the Kemex Chemical Outfits provide many hours of fascinating fun. With the apparatus and materials contained in them a boy can make inks and soaps; dye wool, cotton and silk, and bleach fabrics that are already dyed; test foodstuffs for impurities; analyse air and water; grow crystals; write with electricity; smelt metals from their compounds; make invisible inks and a chemical garden; prepare gases, and perform a host of other interesting chemical experiments.

The Outfits include everything necessary, and the hundreds of experiments that can be made are described in a simple manner in an attractive Manual that is included in each Outfit. The Manuals are illustrated with a series of actual photographs showing how the apparatus required is fitted up, and the manner in which each experiment is carried out.




No. 2


No. 3

No. O Kemex Outfit

75 Experiments

This Outfit includes a supply of specially selected chemicals, packed in airtight containers, together with a length of Magnesium Ribbon, sufficient to perform 75 attractive and varied experiments. The apparatus provided includes Test Tubes, Test Tube Brush, Delivery Tubes and Corks, and a simple and highly efficient Spirit Lamp that makes the Outfit completely self-contained ... ... Price **5/-**

No. 1 Kemex Outfit

130 Experiments

This Outfit includes the whole of the contents of the No. O Outfit, together with further chemicals that increase the number of experiments that can be performed to 130. The additional apparatus includes a Test Tube Holder, Glass Stirring Rod, Funnel and Filter Papers ... ... Price **7/6**

No. 2L Kemex Outfit

250 Experiments

This Outfit includes the whole of the contents of the No.1 Outfit, and further chemicals that increase the range of experiments up to 250. The additional apparatus includes a porcelain Evaporating Dish, Special Test Tubes to withstand high temperatures, a handsome Test Tube Stand, and an Evaporating Stand including a Ring, with Wire Gauze ... ... Price **15/-**

No. 2B Kemex Outfit

This is exactly the same as the No. 2L Kemex Outfit, except that a highly efficient Bunsen Burner, with the necessary length of rubber tubing, is included in place of the Spirit Lamp ... ... Price **15/-**

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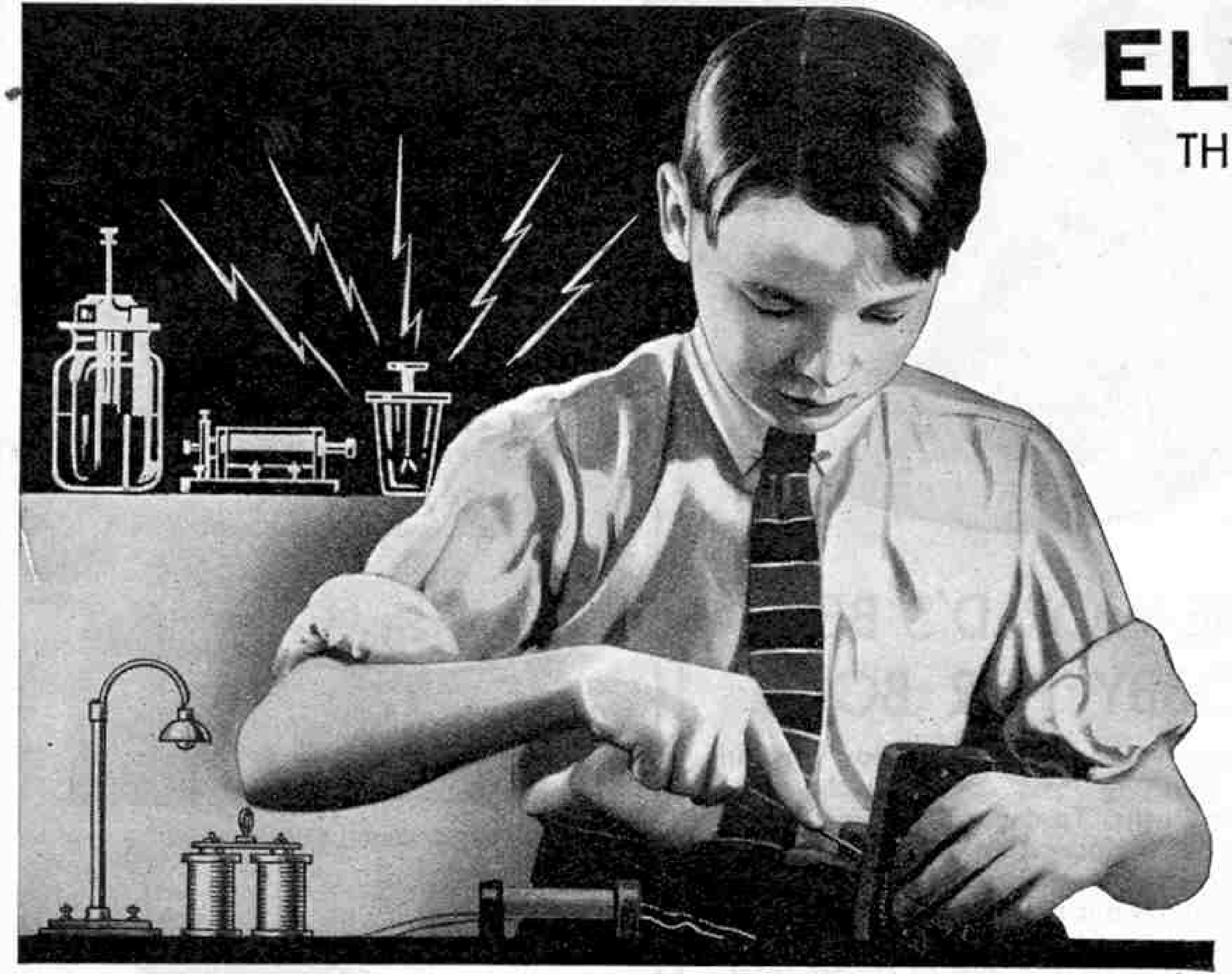

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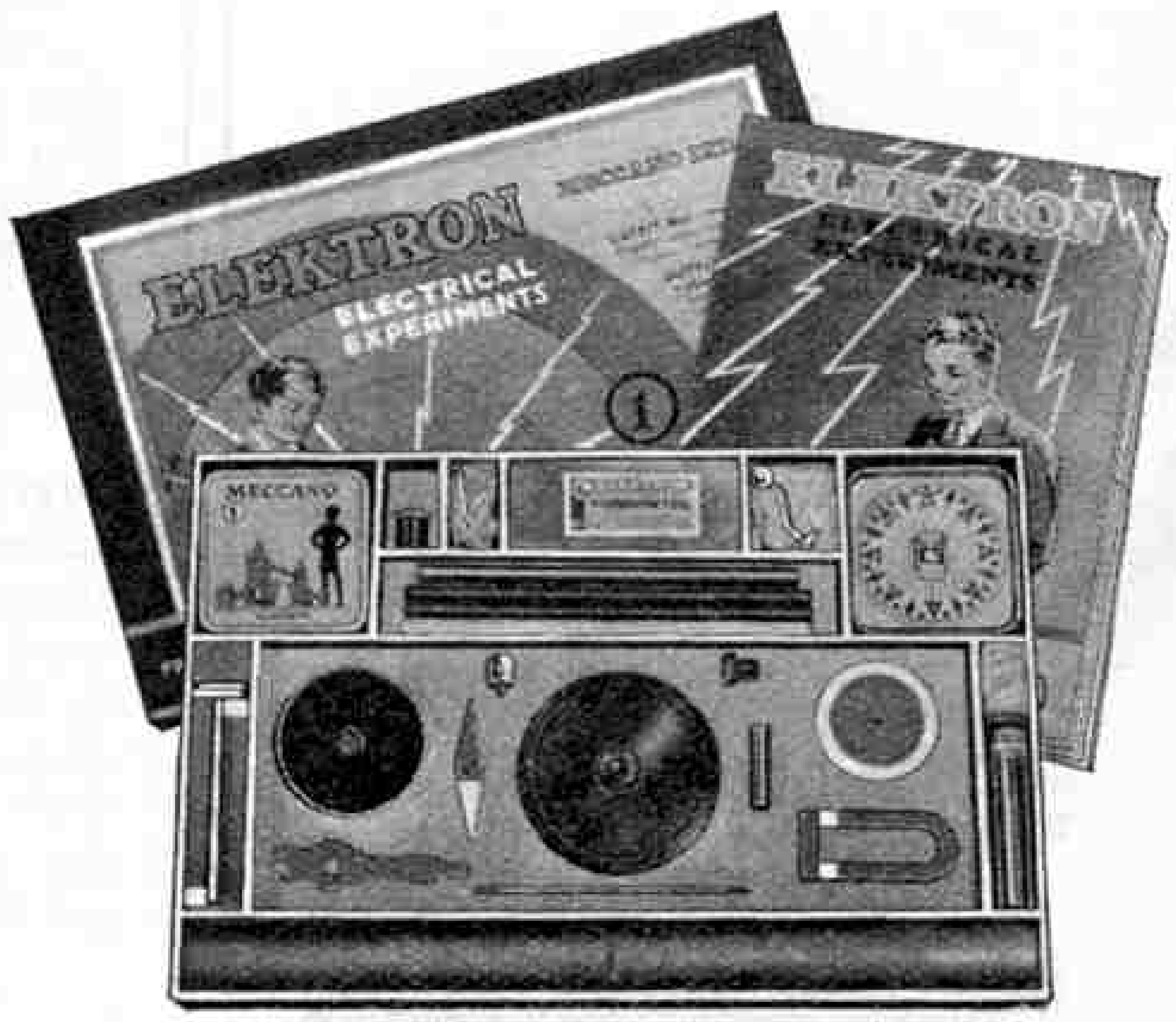

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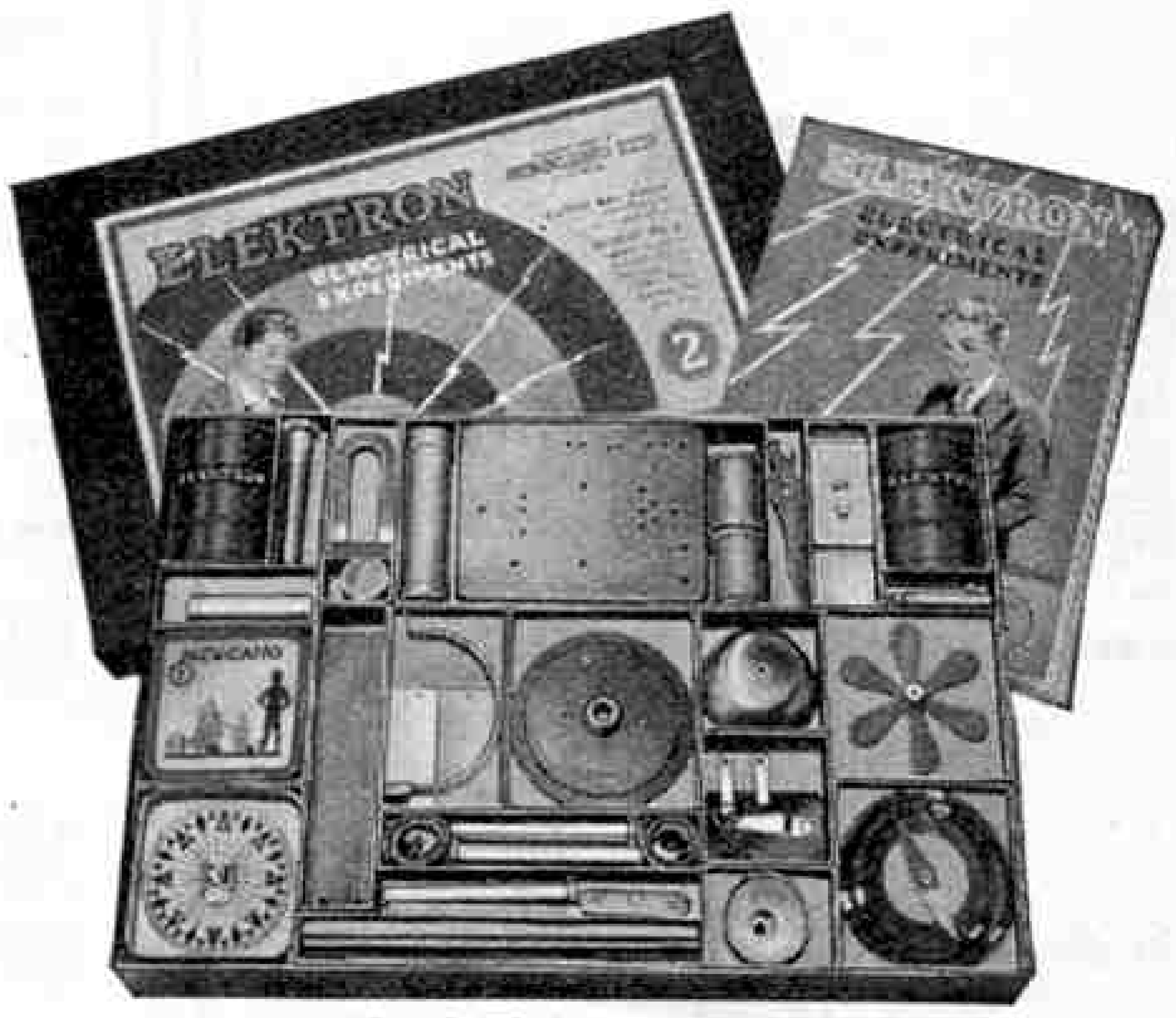

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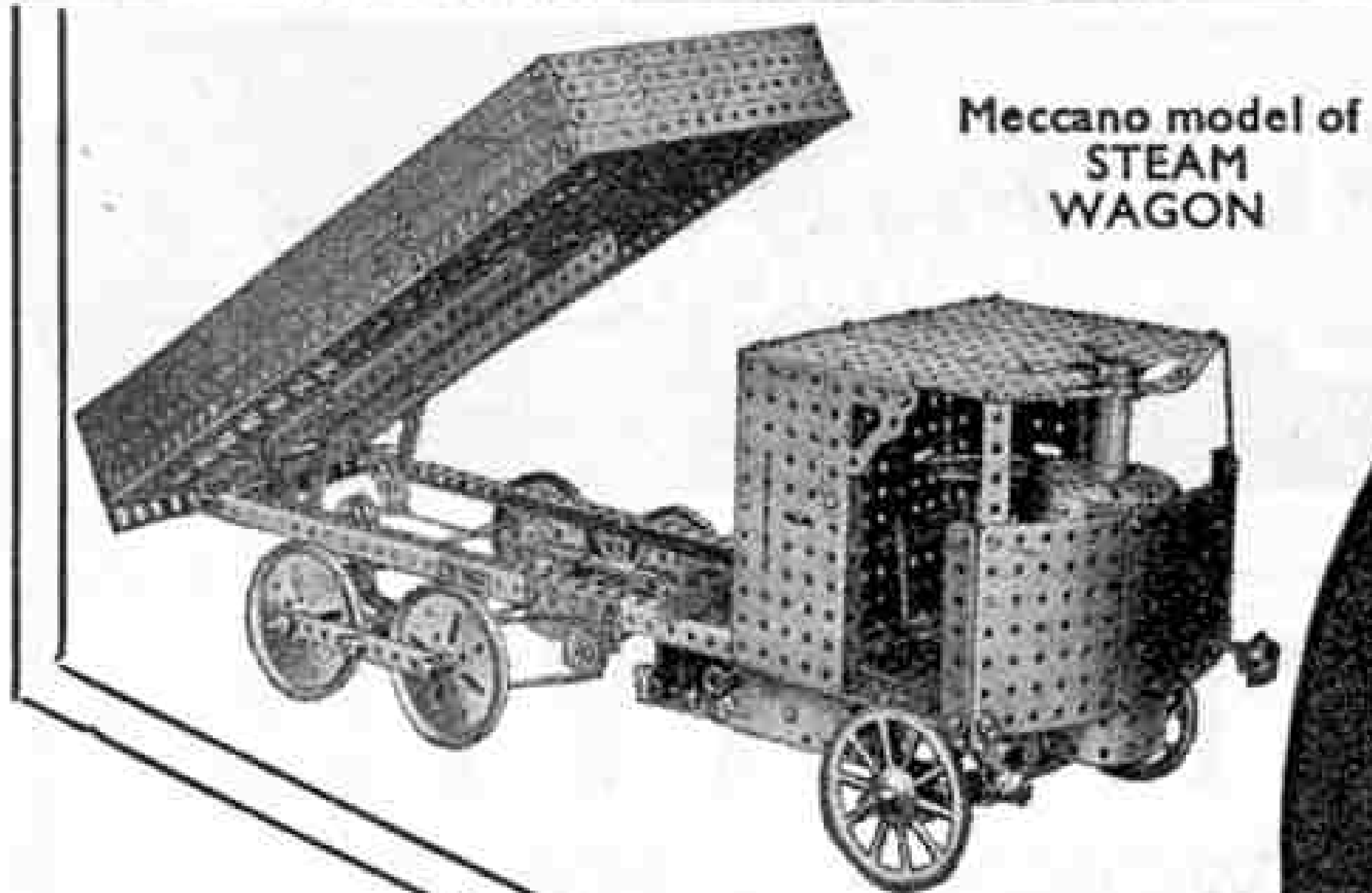

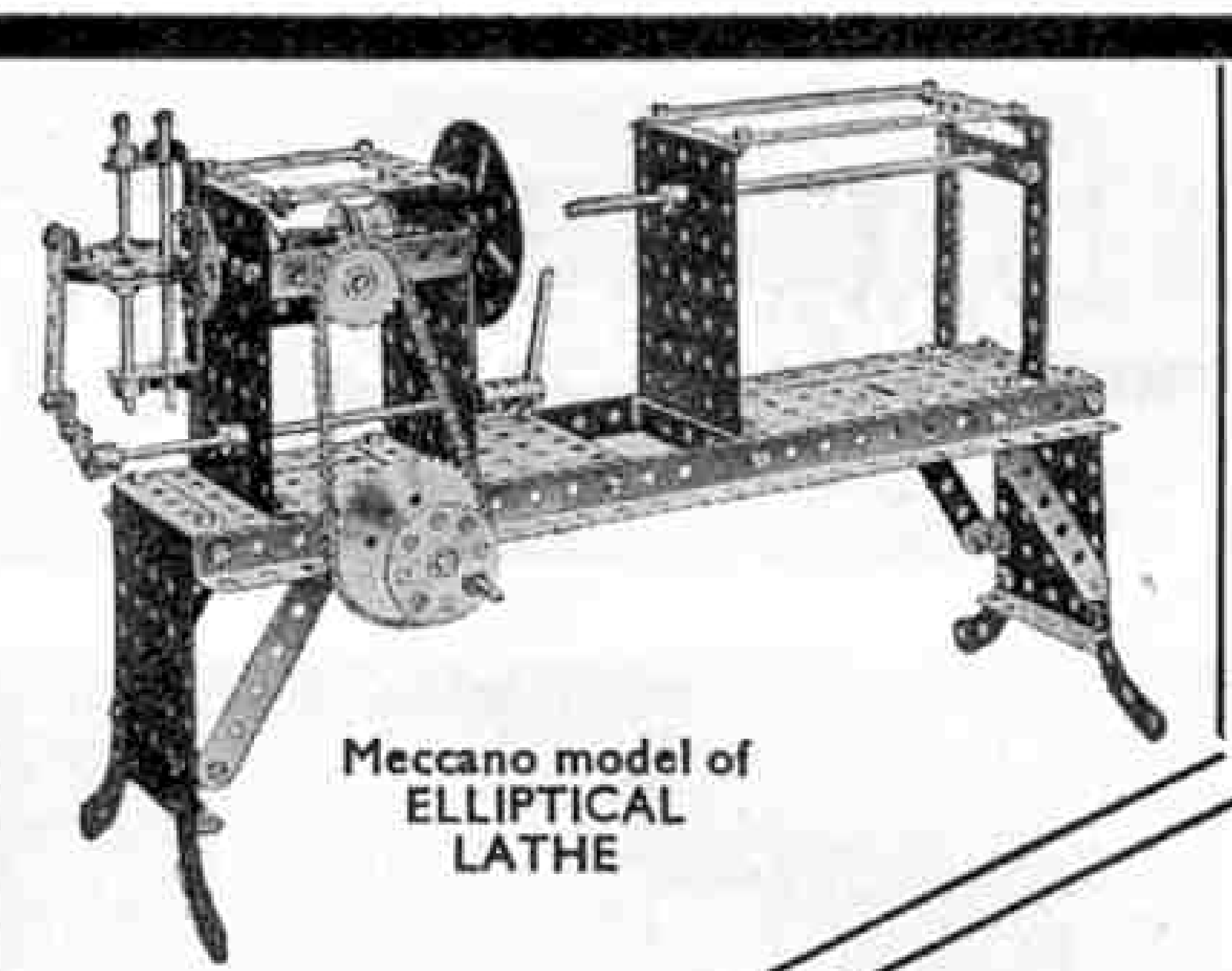

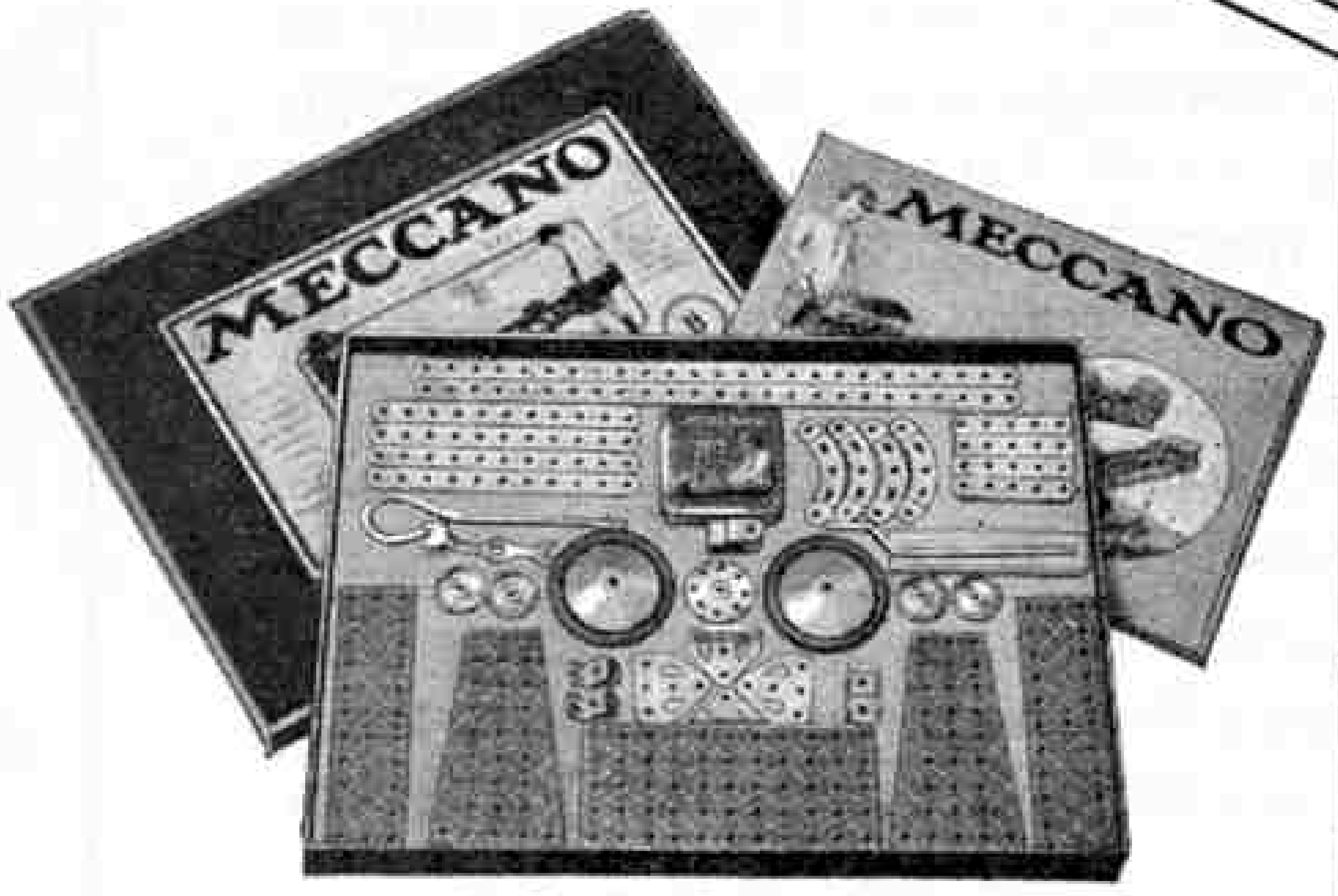

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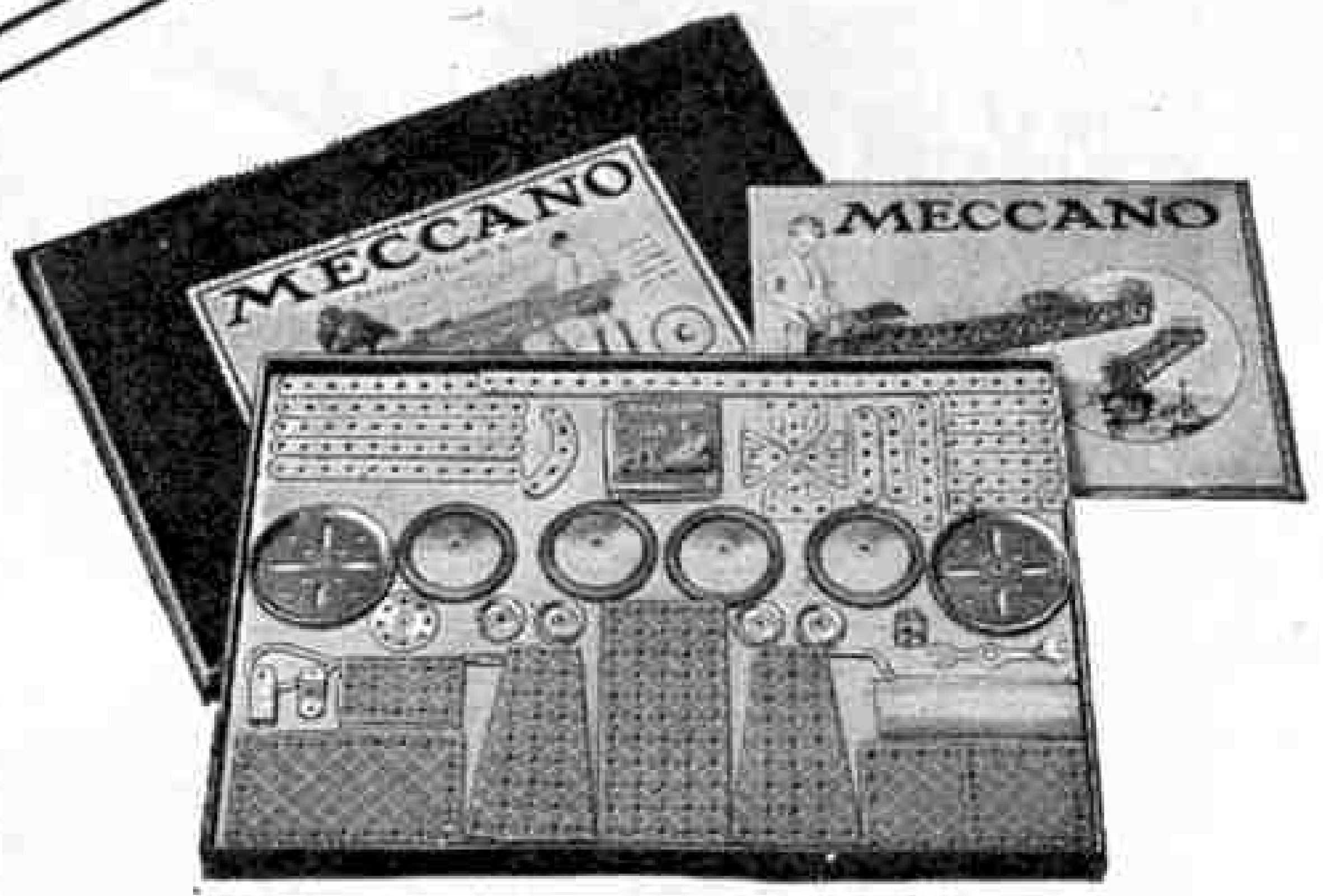

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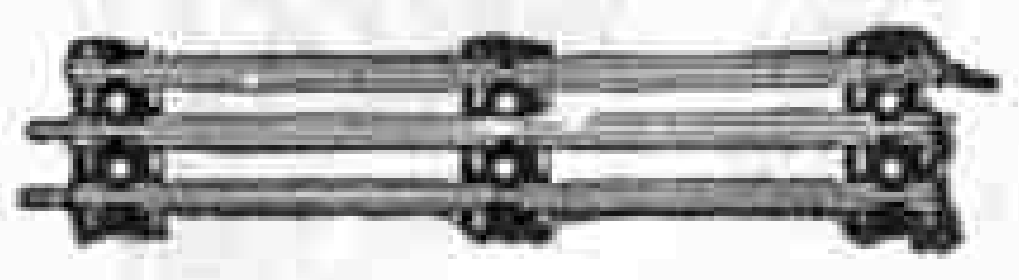
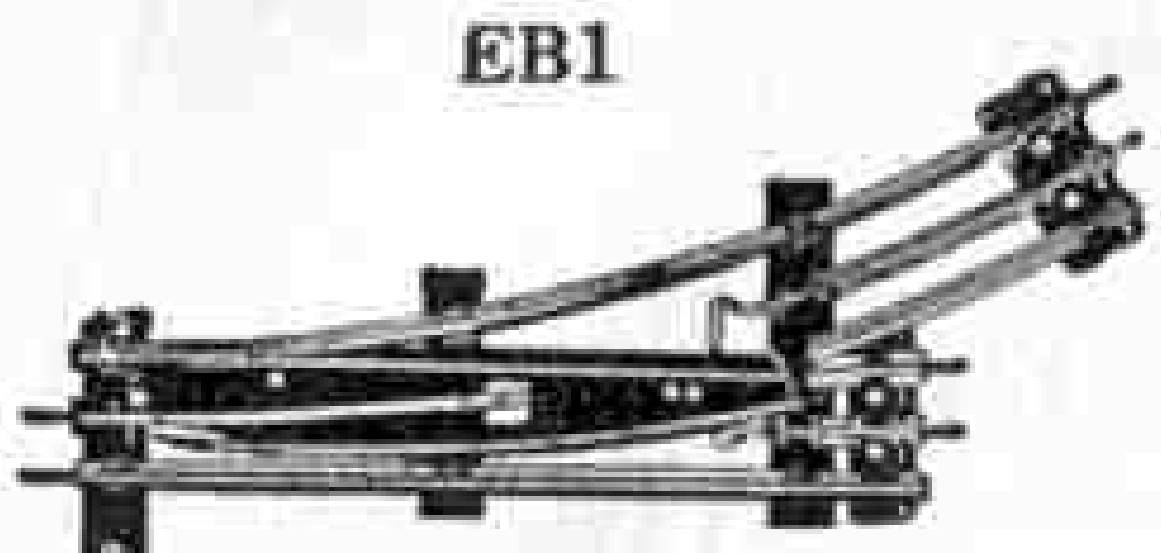
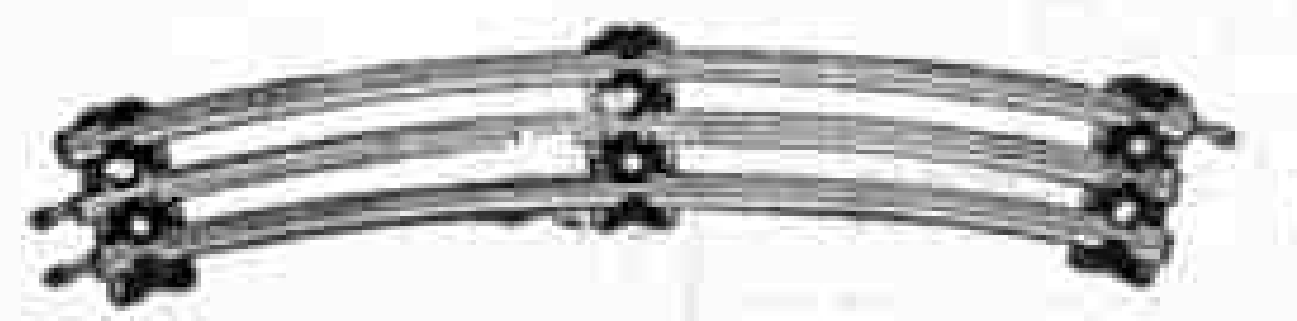
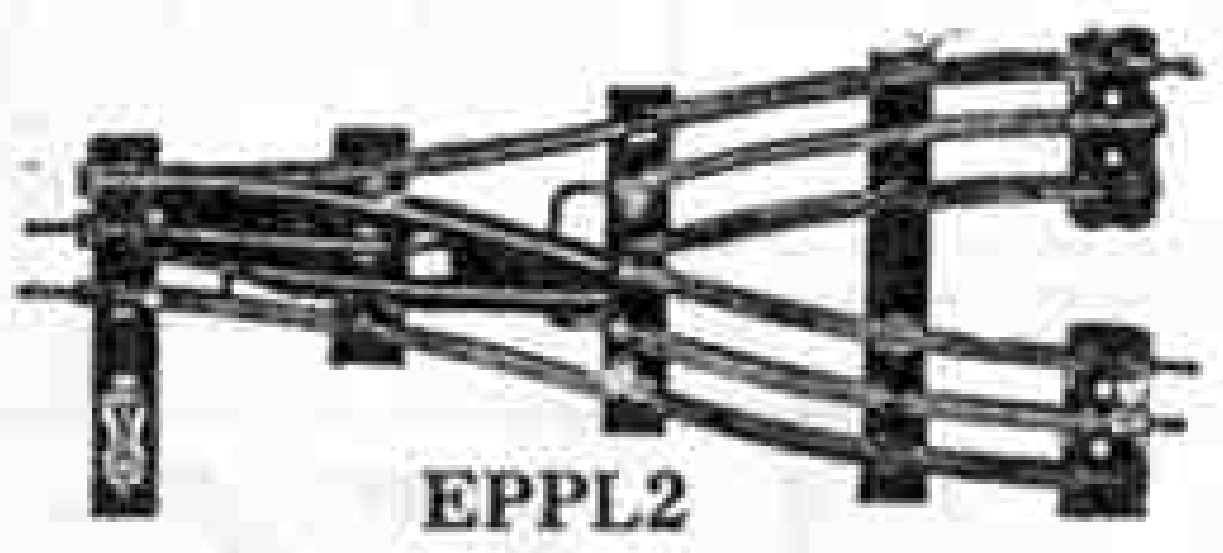

EB1

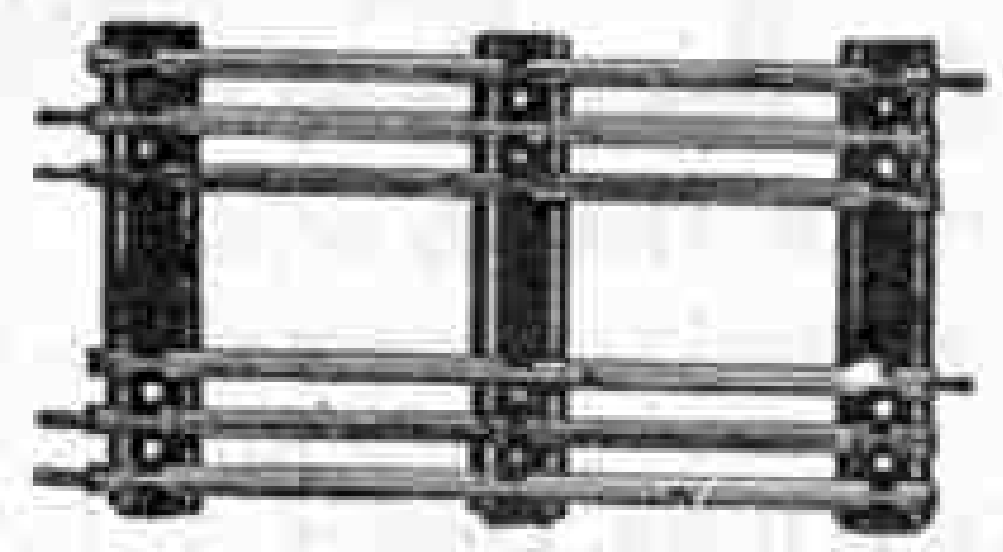

EPPL2

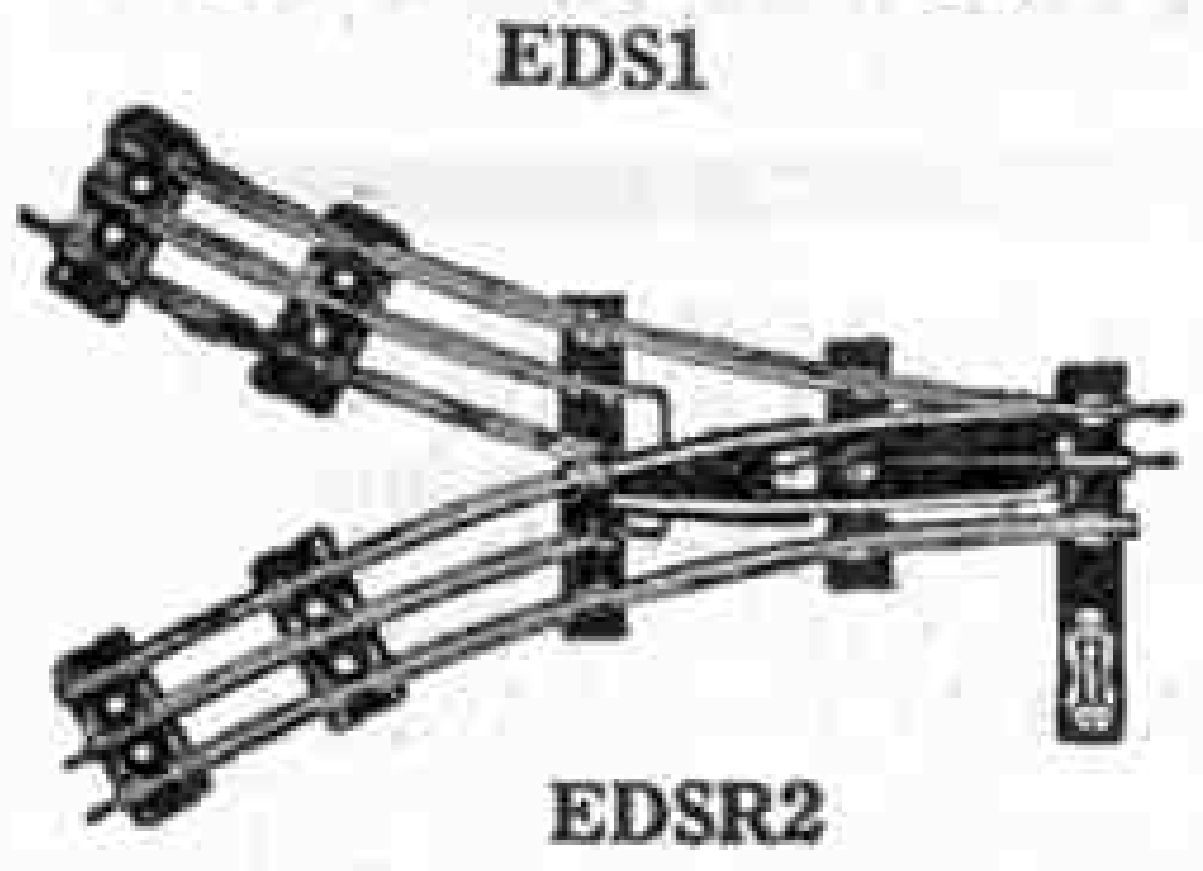
EA2½

EB½


EA2


EPPL2


EDS1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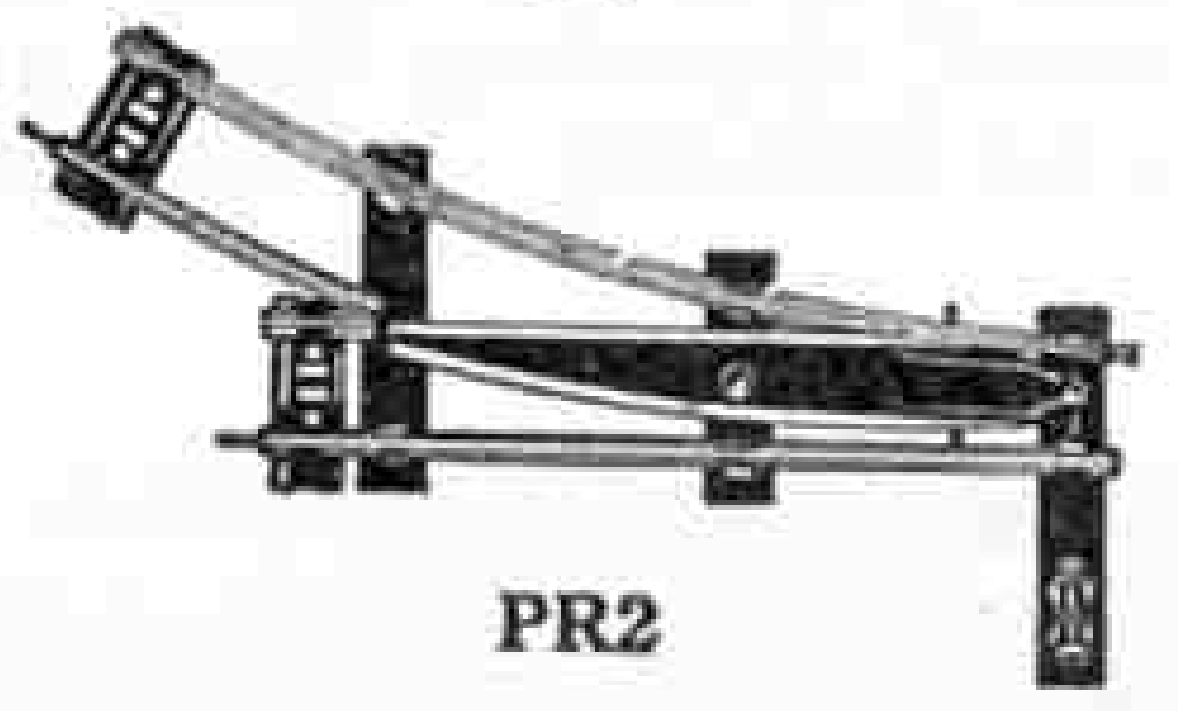
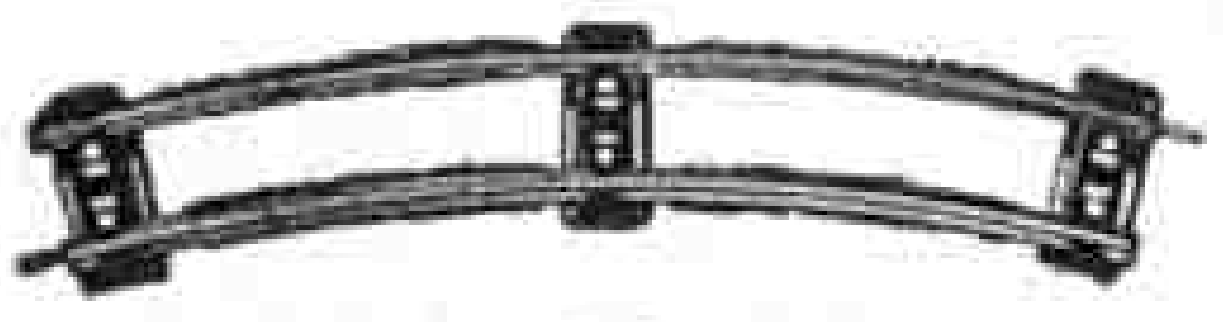
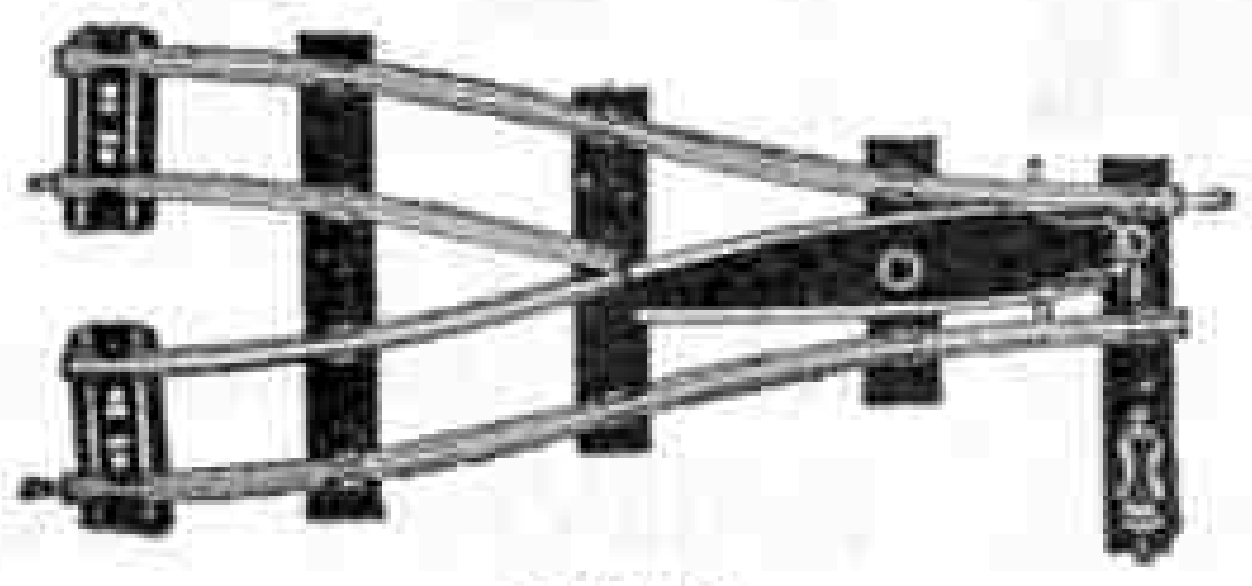
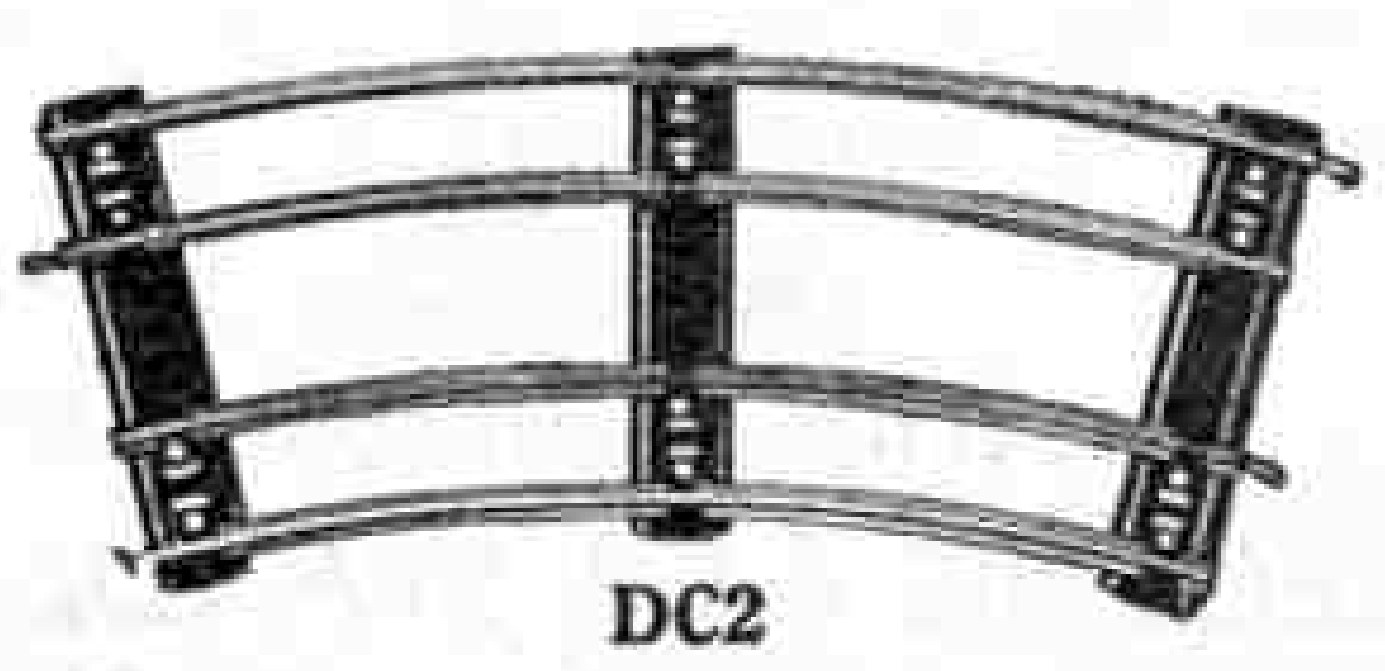

PR2


A2

CA2


PPR2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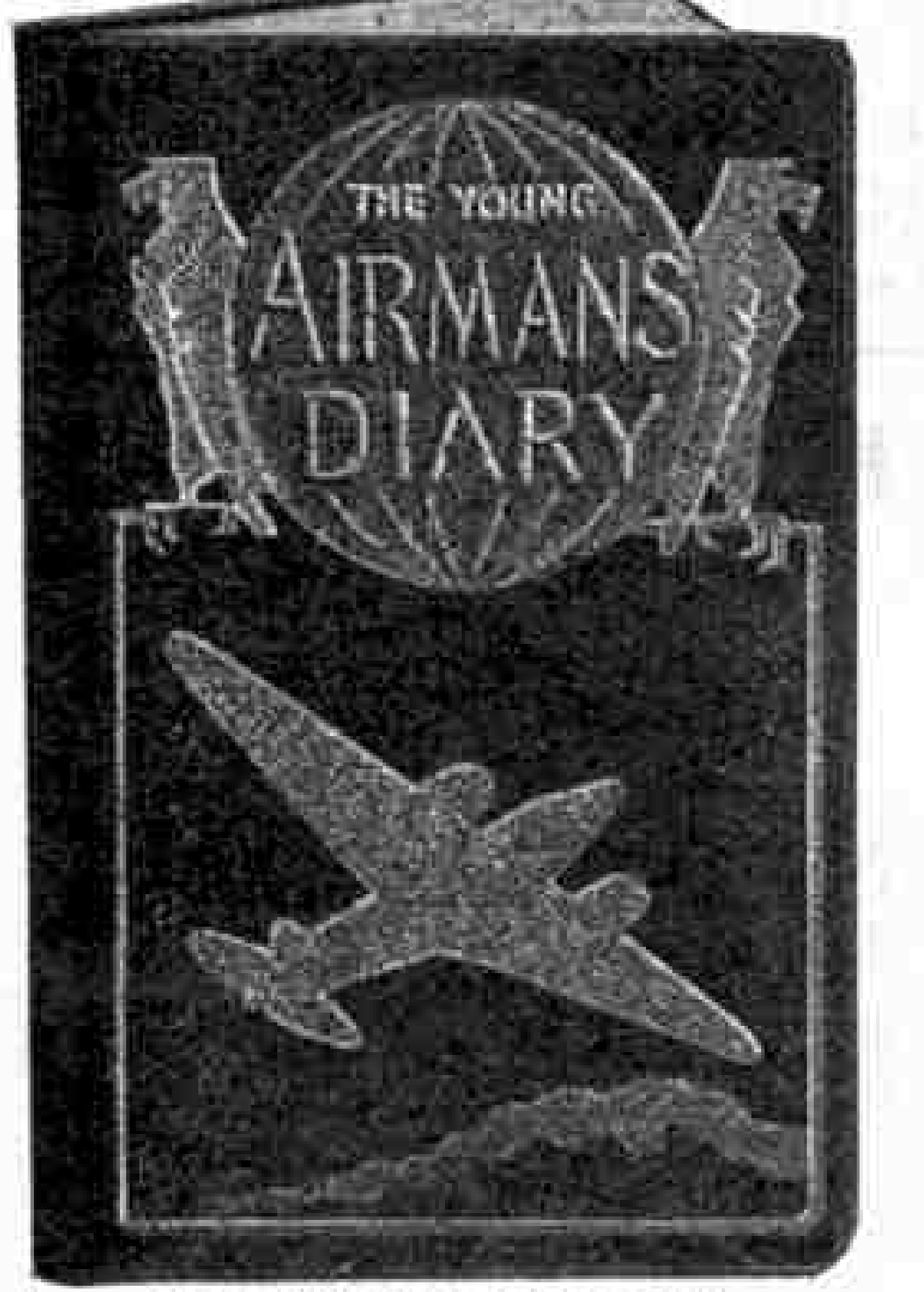

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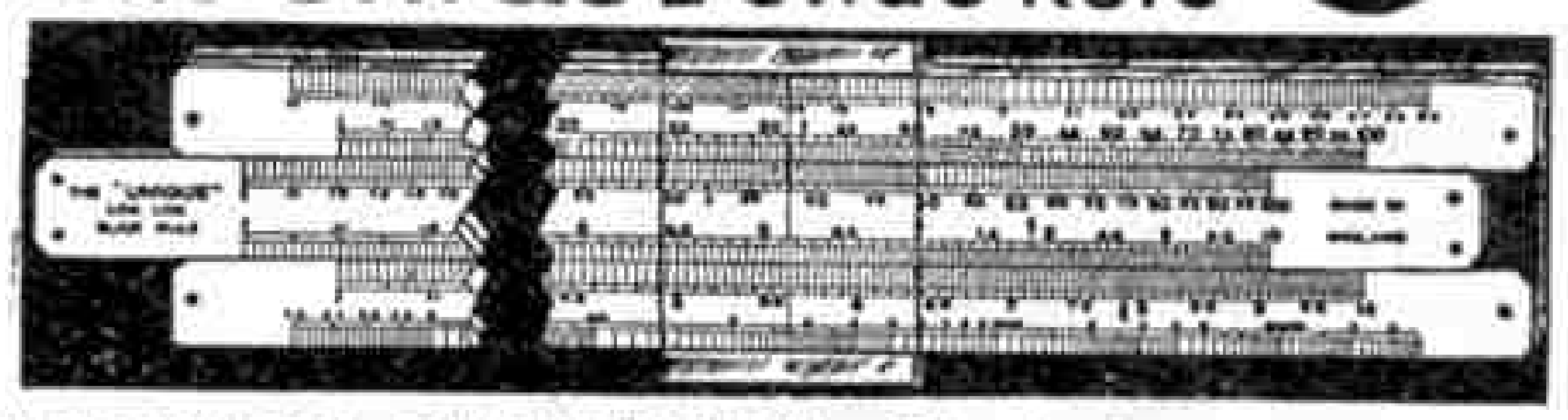

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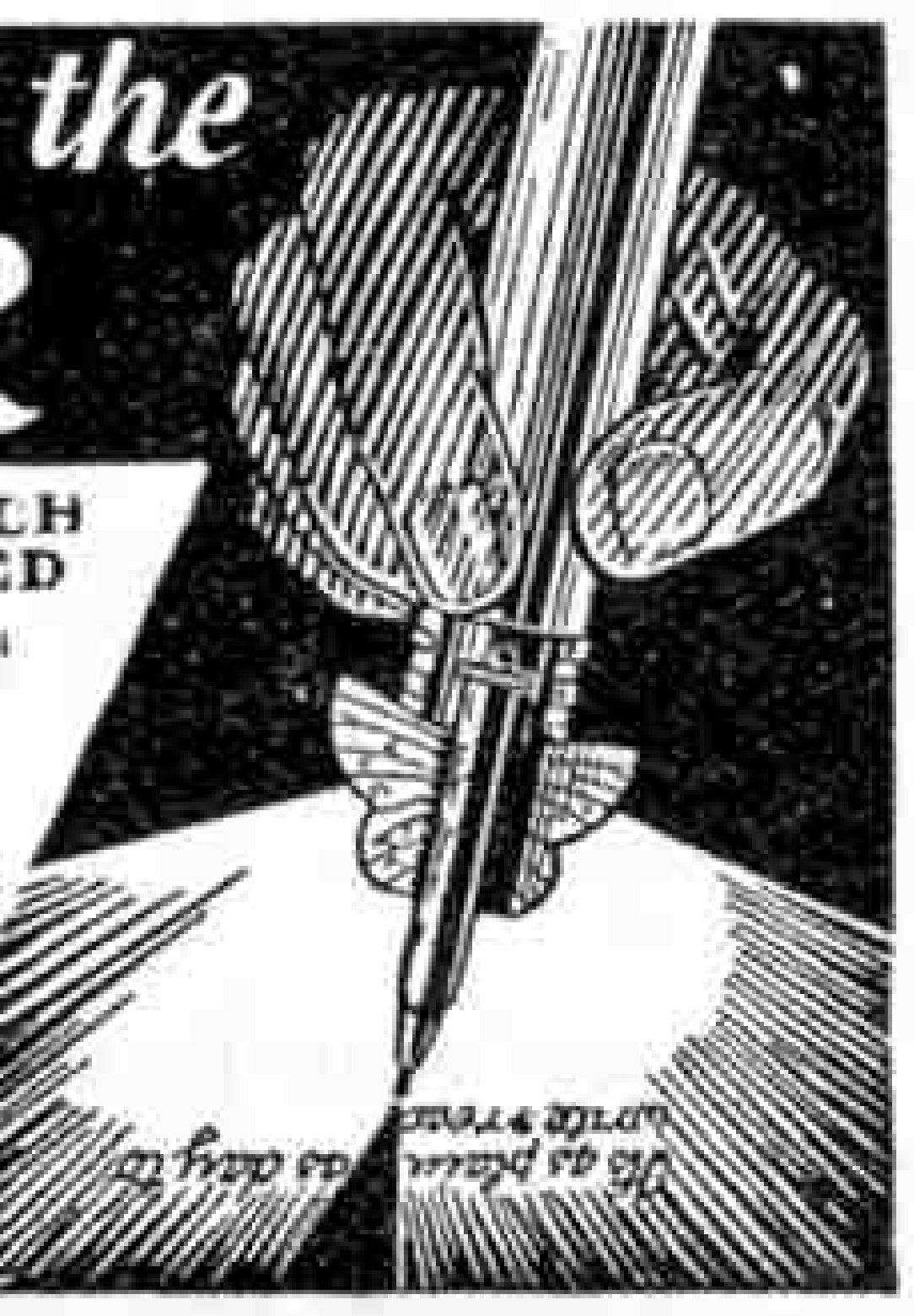

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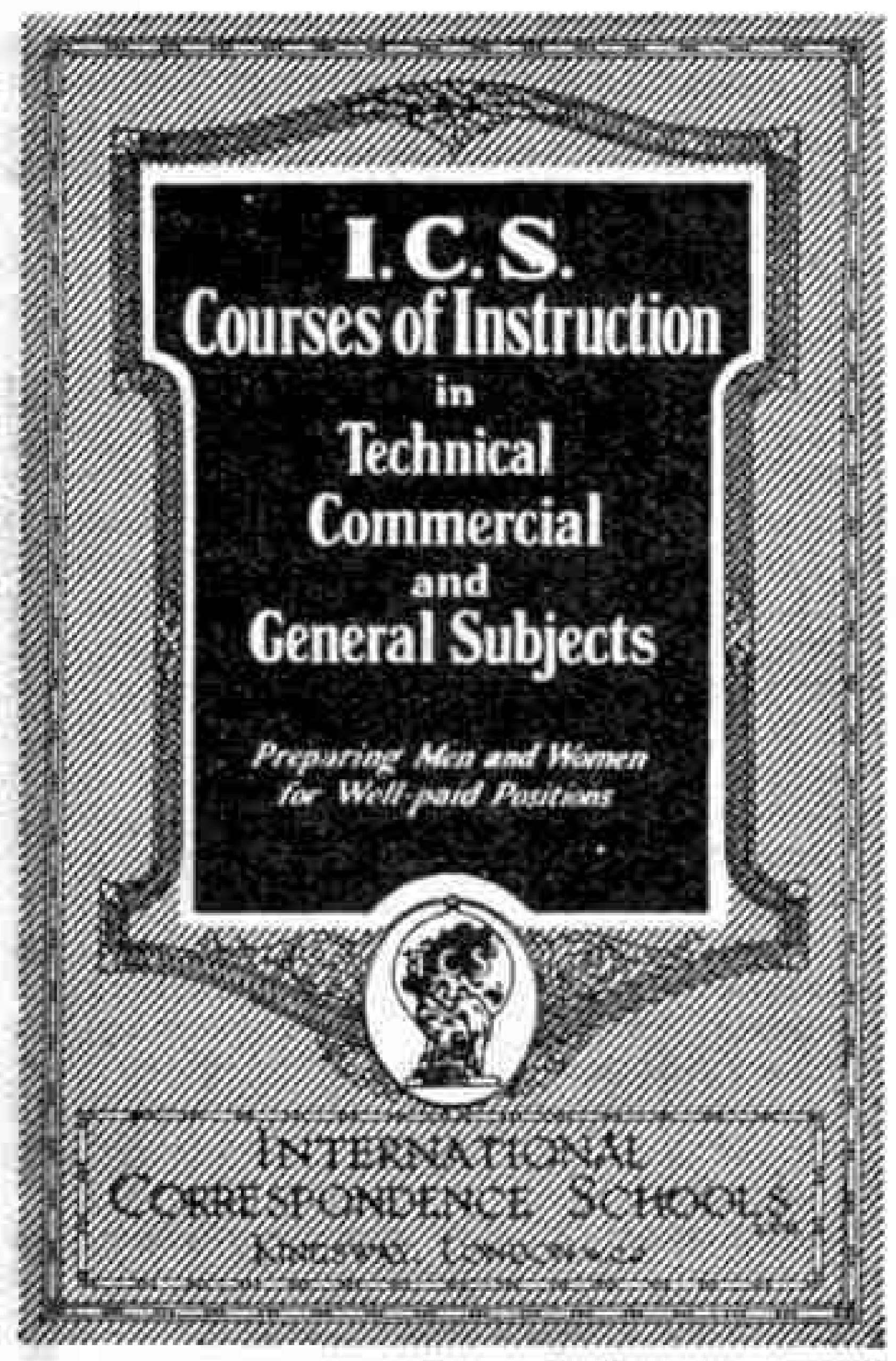

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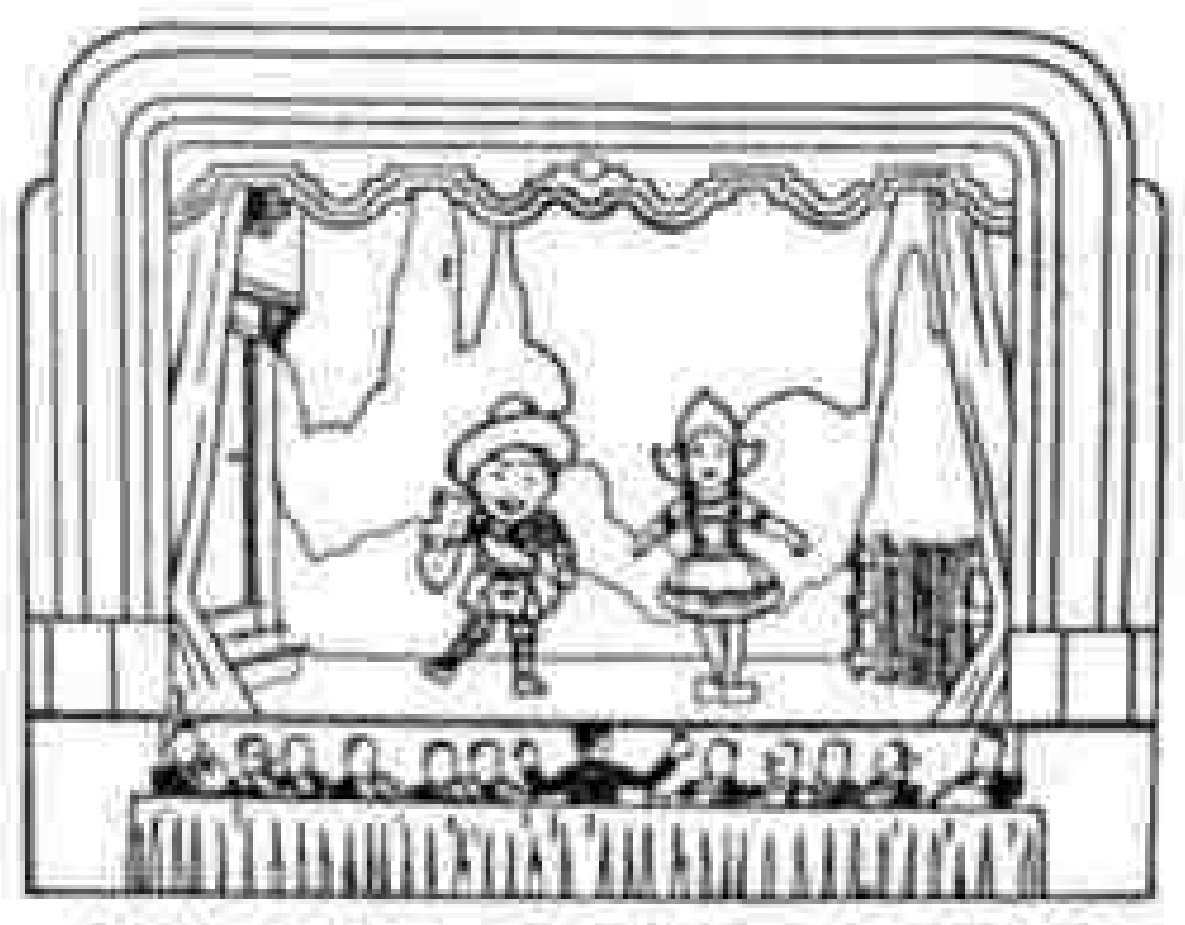

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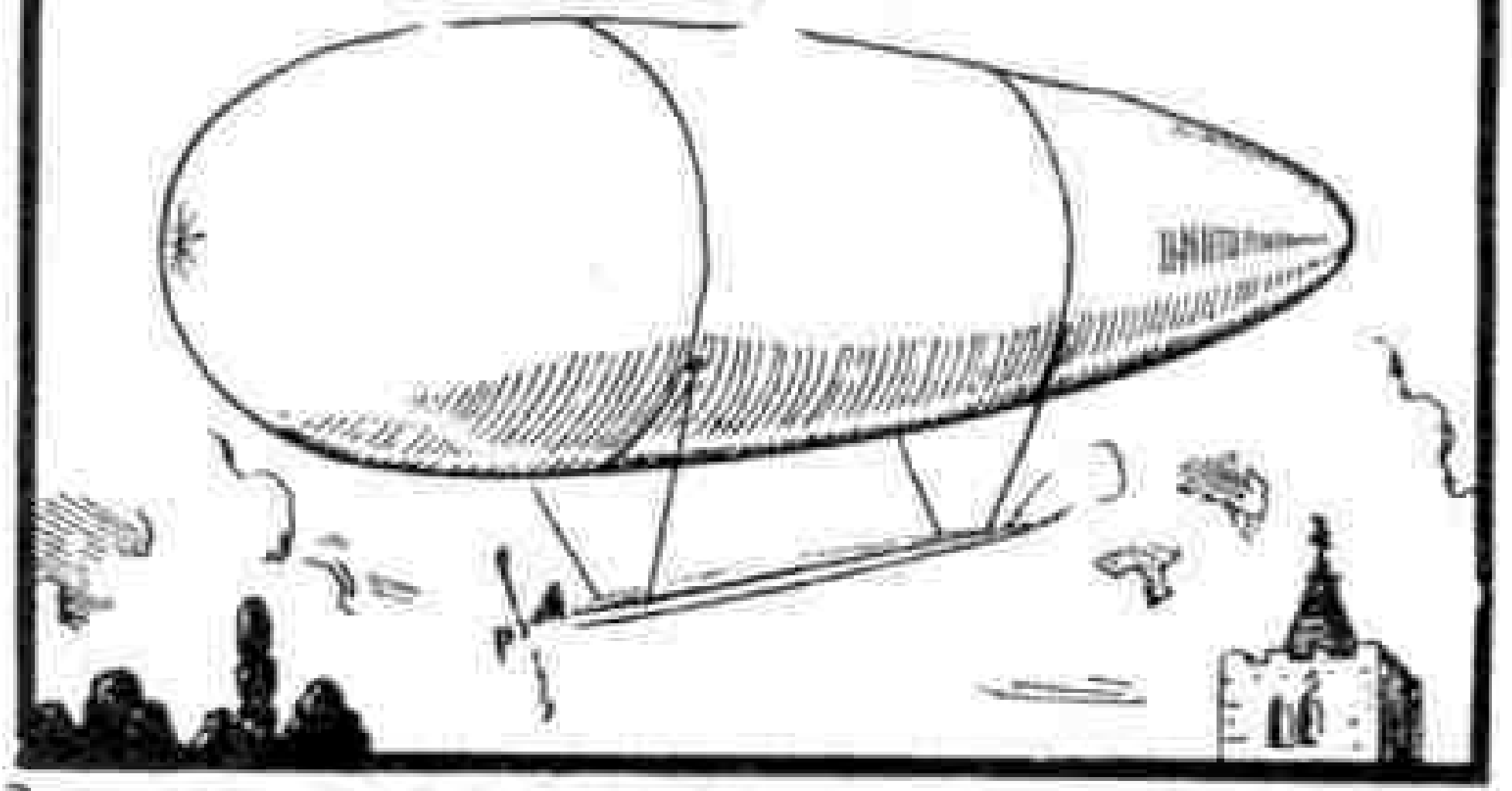

The first real Flying Model Airship. 3 ft. long; 12 in. dia. inflated. Self-lifting. Elastic Motor propulsion. Controllable for flying height and direction.

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Obtainable from leading Toy Dealers and Stores
If in difficulty, write to the Sales Agents:

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YOU SHOULD SEE THE NEW "PINGO" PICTURE PRINTING SETS being demonstrated at:
ARMY & NAVY STORES, HARRODS, PETER ROBINSON (London). BARKERS (Kensington). BON MARCHE (Gloucester). BENTALLS (Kingston). FENWICK (Newcastle). GREYS (Birmingham). GRANTS (Croydon). JONES (Bristol). LEWIS'S (Manchester, Birmingham, Leeds, Liverpool and Glasgow). MORGAN (Cardiff). MID. DRAPERY CO. (Derby). STAFFORDS (Brighton). WALSH (Sheffield). WILES (Manchester).

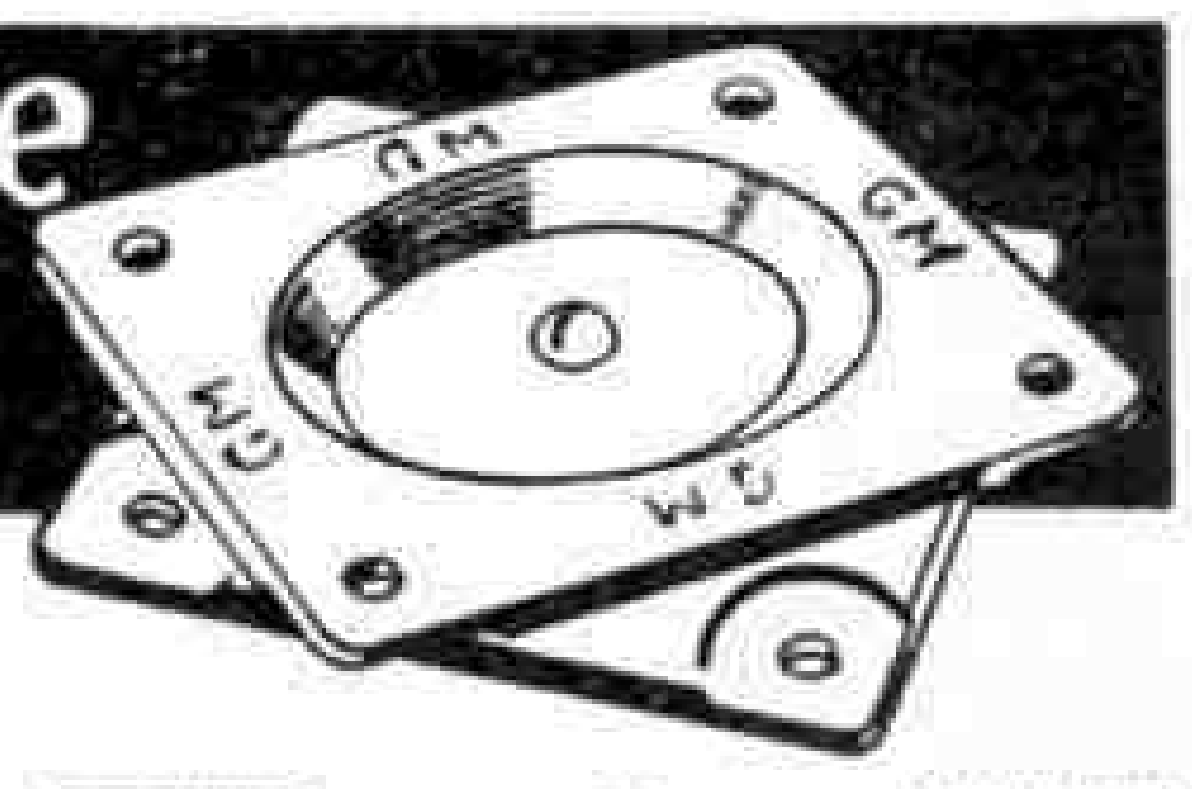
"HOME TOYMAKING," just published, with 180 illustrations of practical amusing toys, 1/2. Dolls' House Paper, brick, tile, etc. Six assorted sheets, 1/6.—Industries, 13, Gordon Avenue, Twickenham.

Electric Home Cinemas. Standard Films Cheap. Lists.—Pictures, 109, Kenlor, Tooting, London.

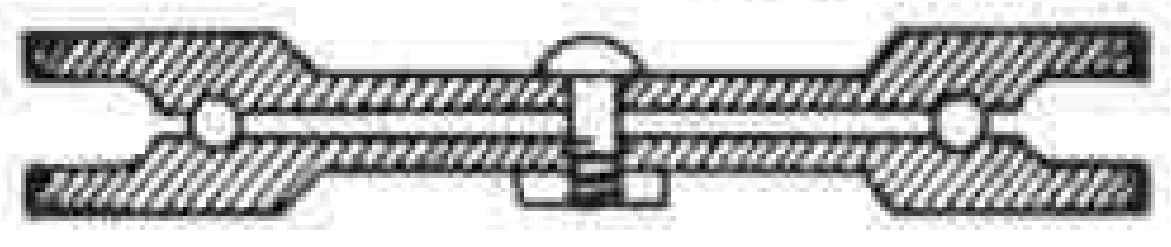
CHEMISTRY
SPECIAL SAMPLE PARCELS

REMARKABLE VALUE. Contents: 1 Bunsen Burner (value 1/6); 1 Beaker, 150 c.c.; 3 Test Tubes, 4" × ½"; 1 Flask, 100 c.c.; Glass Tubing; Rubber Connection Tubing; Corks; Filter Papers, etc. 3/6 value for only 2/6, post etc., 4d. (Colonial post 9d.) **HERBERTS & CO. (Dept. F.24)**, 81, Clapham Park Road, London, S.W.4.

Ball Race TURNTABLE



WITH MECCANO, TRIX AND YOUR OWN BUILT-UP MODELS



A REVOLUTION HAS OCCURRED

and the 'G.M.' BALL RACE TURNTABLE IS UNDERNEATH IT ALL.

If your model weighs anything up to **56 lbs.** you can turn it with your little finger **BECAUSE** there are 45 Hardened Steel Balls in accurately machined races with adjustable centre screw, therefore—

THERE IS NOTHING TO FEAR from wobbling. All over the World 'G.M.' Turntables are giving satisfaction.

Only 1/6 each or 1/10 Post Free

From your Local Toy Shop or write **DIRECT** to the Manufacturers:

G. M. PATENTS CO.
26, NEW BUILDINGS, PRICE ST., BIRMINGHAM 4

P.S. The Improved Pattern Gear Wheel to fit the above 'G.M.' Turntable now ready. 1/- each. Post Free 1/2.

READERS' SALES

Wanted. Large Kodak developing tank and accessories, rapid electric printing box and Meccano H.V. 220-250-volt electric motor and rheostat.—Plowden, 15, Bowmont Gardens, Glasgow, W.2.

Sale. Complete Gauge O Railway. Cost 16 gns. 5 gns. or offer.—Waldron, Cedars, Marlow.

Films. 30 feet, 9.5 mm., 1/- each, also others; 100 feet, 35 mm., 11d.—Robt. Hobbs, 20, Mansebrae, Glasgow, S.4.

Sale. Construments Set 100, cost 37/6, sell 20/-. Frog Puss Moth, cost 17/6, sell 10/-. Both excellent condition.—Foskett, Branscombe, Ashurst Road, Tadworth, Surrey.

Bargains: 2 large boxes Wireless parts, valves, diagrams, worth £1—5/6 each. Modern powerful 3-valve Wireless, valves, speaker, cabinet, worth £4—25/-. 2-valve set 10/-.—60, Avenue Approach, Bury St. Edmunds.

Gem Air Gun, cost 35/-, 15/-. Three House 'Phones and spare case, cost 70/-, 15/-.—4, Kettlebaston Road, London, E.10.

Sale. Toy Cinematograph, films, slides, cheap. Apply—290, North Circular Road, Dublin.

9.5 m.m. Projector. Cost 55/-. All voltages. With films. As new, 35/-.—138, Fordel Road, Catford, London.

New Construments "20," accept 11/-. Ukulele, cost 17/6, accept 8/6. Also many books and magazines, sell cheap.—"Darley," Stainforth, Doncaster.

Sale. 7/6 Kay and 4/6 B.G.L. Chemistry. Hardly used, 5/9. Junior Typewriter, cost 15/6, take 5/6.—Bickmore, 22, Dunmow Road, Andover, Hants.

Gauge OO Bing clockwork train, rails and accessories—stamp for list. Also postcard enlargements of showmen's traction engines, 6d. each, post free.—Wilkinson, 17, Princeville Street, Bradford.

Gent.'s cycle, 20 in. frame, 26 in. × 1½ in. Dunlops. Fine machine, suit short rider, bargain, 30/-.—20, Dartmouth Road, N.W.4.

Student's chemical balance, new, 27/6. Also laboratory apparatus for disposal, cheap.—Write, Harvey, 2, Wellington Avenue, Chingford.

Cheap. "B.O.P.'s," January 1931 to August 1934. Perfect condition. Good Microscope.—124, Belmont Road, Bristol 6.

"Meccano Magazines," January 1929–August 1935. 1/- Year. Postage extra.—Bateman, Fairleigh, Draughton, Skipton.

Sale. Standard size cinema films and cinematographs. Send for particulars.—10, Melbourne Grove, Horwich, Lancs.

Pathescope Home Movie projector, resistance, super attachment, new screen (3 ft. 3 in. × 2 ft. 3 in.), 18 super reels (11 titles), and all accessories. £14, bargain.—Howe, 4, Rosaville Road, Fulham, London.

Ideal Christmas Gift. '20' and 'Plus' Construments Outfits. Together make £100 worth scientific instruments. Hardly used. 12/6 each.—Harris, 23, Maindy Road, Cardiff.

Sale. "M.M." 1923–1933. Good condition, unbound. Lot or separately. Offers?—W., 55, Cowan Street, London, S.E.5.

Sale. Two Marconi, one Columbia, brand new, 1935, £4/4/-; Two-Valve Cabinet Wireless Sets, complete with new Batteries, Valves, Loud Speakers. Take £3/10/-; also few old 3 and 4 valve Sets at £2.—Cadet F. A. Moyle, "Hesperus," Nautical College, Pangbourne, Berks.

Bargains. 22/6 Bing Cinema 250-v., three Films, 15/-. 16/9 Bowman M135 Steam Engine, 10/-. Dynamo, 5/-. Two Vacuum Tubes, 5/-, worth double. Stamp particulars.—Ravensdale, Corpach, Inverness Shire.

Sale. Size 4 Lott's Bricks, 10/-. Accessories, 2/6. 7 1/48 Scale Aeroplanes, 6d. each.—Wickham, 48, Rose Avenue, South Woodford, E.18.

Selling Conjuring Apparatus. Good effects cheap. Stamp for list.—D. Sanson, 194, Grange Loan, Edinburgh.

Sale. "M.M." 1923–1933. Good condition, unbound. Lot or separately. Offers?—W., 55, Cowan Street, London, S.E.5.

Sale. "M.M.'s," Jan. 1930 to date, 8 a 1/-; "Modern Boys," No. 131 to date, 12 for 6d.; all complete, minimum lot, 2/6. Ensign 2¼B box camera, cost 15/-, 4/-. 6 volt D.C. gauge O tank loco, 24 straights, 12 curves, 2R, 1L-hand points, 2 ft. radius; cost 55/-, 17/6. Excellent condition—also the following: 60 4d. school and adventure stories, 7 for 6d.; Percy Westerman Omnibus of Stories, 1/6. Several good 3/6 books, 1/-. List, stamp.—D. L. Johnston, 64, Glisson Road, Cambridge.

Sale. Gauge O rolling stock, rails and accessories in good condition. List.—Owen, 21, Church Road, Gillingham, Kent.

Electric Speed Boat. Cost 50/-. Offers?—Sewell, 12, Goldsmith Road, London, W.3.

Pathescope Home Movie (double claw), complete with Super Attachment, Type "C" Motor and Resistance in perfect order, £8/8/-. Pathescope Model "B" Motocamera, £4/12/6. Super Films for sale from 10/-.—J. G. Kirkham, 78, Orford Avenue, Warrington.

Foreign Stamps. Disposing of collection in sections. Bargain offer first five genuine applicants.—R. T. Box, The Laurels, Compton Road, Lindfield, Sussex.

Advertiser has numerous stamp duplicates for disposal by sale or suitable exchange.—Price, "Springfield," 22 Tyrfran Avenue, Llanelly.

Wanted. Magnets, 1929 or 1930. Schoolboys' Own, 1932. Must be clean. Send list.—W. Brook, Coningsley House, Hereford.

This Month's Special Articles

	Page
Aire and Calder Navigation	700
Air News	706
Books to Read	730–2
Building the "Princesses" at Crewe ...	716
Competition Page	761
Conjuring Tricks for Christmas ...	702
Early Continental Locomotive Types	722
Engineering News	694
Fireside Fun	763
From Our Readers	734
Ghost Story: "The Speed Boat Passenger"	733
Golden Gate Suspension Bridge ...	693
Great Ports, XVII—Capetown ...	688
Guild Pages	748–9
Heat as an Enemy of Speed	736
Hornby Railway Company Pages ...	750–755
Lighthouses along the Californian Coast	710
Meccano Aero Engines	740
Meccano Domestic Gadgets	744
Meccano Fire Engine with Real Pumps	737
Model Building Contests and Results	746–7
Optical Illusions	728
Puzzles Page	705
Railway Bridges	726
Railway News	718
Southampton to Havre by "*St. Briac*"	690
Stainless Steel, Development of ...	714
Stamp Collecting and Stamp Gossip ...	757, 759
Suez Canal	696
Suggestions Section	738
Testing "Bristol" Aero Engines ...	708
Through the Alps on the Footplate ...	698
"West Coast Express," New Zealand	720
Yorkshire's Underworld	712

Ship Photograph Postcards

Splendid real photographs of 600 Liners, Freighters, Sailing Ships, Cunard White Star, Clan, Blue Funnel, Harrison, Elder Dempster, Blue Star, Lamport, Bibby, Ellerman Lines, etc., **2d.** each, **2/-** per dozen, post free. Send 3d. for illustrated list and specimen postcard.

B. & A. FEILDEN
12, Harlech Road, Blundellsands, Liverpool

Readers' Sales advertisements continued from previous column.

Stamps for sale, very cheap, great value.—Stewart Reid, Deramore Drive, Belfast.

Sale. "M.M.'s," 4 volumes, 1924, 1925, 1926, 1927. What offers? Sound condition.—3, Landsdowne Road, Bridlington.

Stabil Model Construction Set, nickel, 350 parts: 170 bolts, rubber tyres, cost 115/-, 52/6 or nearest offer. Clockwork motor, almost new, 10/-. 400 different European stamps 1/6. Particulars.—David, 96, Greencroft Gardens, London, N.W.6.

Sale. Rails, rolling stock, accessories, cheap. Also clockwork gramo. motor and pickup, 7/6. Portable gramophone, 5/6.—Sheppard, 12, Newton Grove, Leeds, 7.

Sale. Electric Speedway, as new, 10/-. Three annuals, 5/-.—Wilson, 17, St. Andrew's Avenue, Ashton, Preston.

Wanted. "M.M.'s," Nov. and Dec., 1929. Good condition. First offers.—J. O'Donoghue, Frankfield, Cork, I.F.S.

Meccano Magazines, 1925 to 1932 inclusive. Motor, Aircraft, Engineering Wonder Books. Excellent condition. Offers.—265, Babbacombe Road, Torquay.

Sale. Three sets Erector. Many extras. Cost £6–10s. Cannot separate. Offers?—Bosley, Ivydene, Broadway, Didcot.

Sale. Bassett-Lowke 4–4–2 Tank engine, No. 596B. Gauge 1 electric, 8-volt D.C. track, reversing. Cost £7–7–0, as new. What offers?—Hindle, 19, Bacup Road, Rawtenstall, Lancs.

Nice collection, 1,600 stamps, whole world, in Victory Album, 10/-.—Creamer, 2, Winscombe Crescent, Ealing, W.5.

Sale. Hobbies A2 fretwork outfit, cost 16/6, accept 9/6. Excellent condition.—Pilkington, 150, Upper Sheffield Road, Barnsley.

Sale. As new, 22/6, Bing Projector. Mains model, 220/250 A.C., 22/6, new. With film, Eskimo Life, 15/-. Bassett-Lowke O gauge steam engine. Good condition, 2 gns., new. Offers?—White, 86, Clarence Road, Derby.

Bing 4-bank portable typewriter (£5/17/6 model), price £2/18/6; Pathe "Kid" complete, £2; Pathe Home Movie, £4/10/0.—85, Killingham Road, Bradford, Yorks. 'Phone 8547.

Cycle. Humber, gent.'s, in good condition, complete, 35/-.—M. Townsend, High Street, Banstead.

MECCANO WRITING PADS are supplied in two sizes, each consisting of 50 printed sheets of tinted paper with cover. Price—Large, 1/- each, and small, 6d. each (post free).

ENVELOPES to match. Price, per packet of 50, 8d. post free.

Meccano Ltd., Binns Road, Liverpool 13.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/- per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/- for six months and 16/- for 12 months (post free); Canada, where the price is 10c. per copy, and the subscription rates 65c. for six months, and $1.25 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 187-189, Church St., Toronto.
UNITED STATES: Meccano Co. of America Inc., New Haven, Conn., Meccano Co. of America Inc., 200, Fifth Av., New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Limited, Third Floor, Paykel's Buildings, 9, Anzac Avenue (P.O. Box 129), Auckland, C.1.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Daryanamal and Bros., Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 2, Lindsay Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

WEBLEY AIR PISTOLS

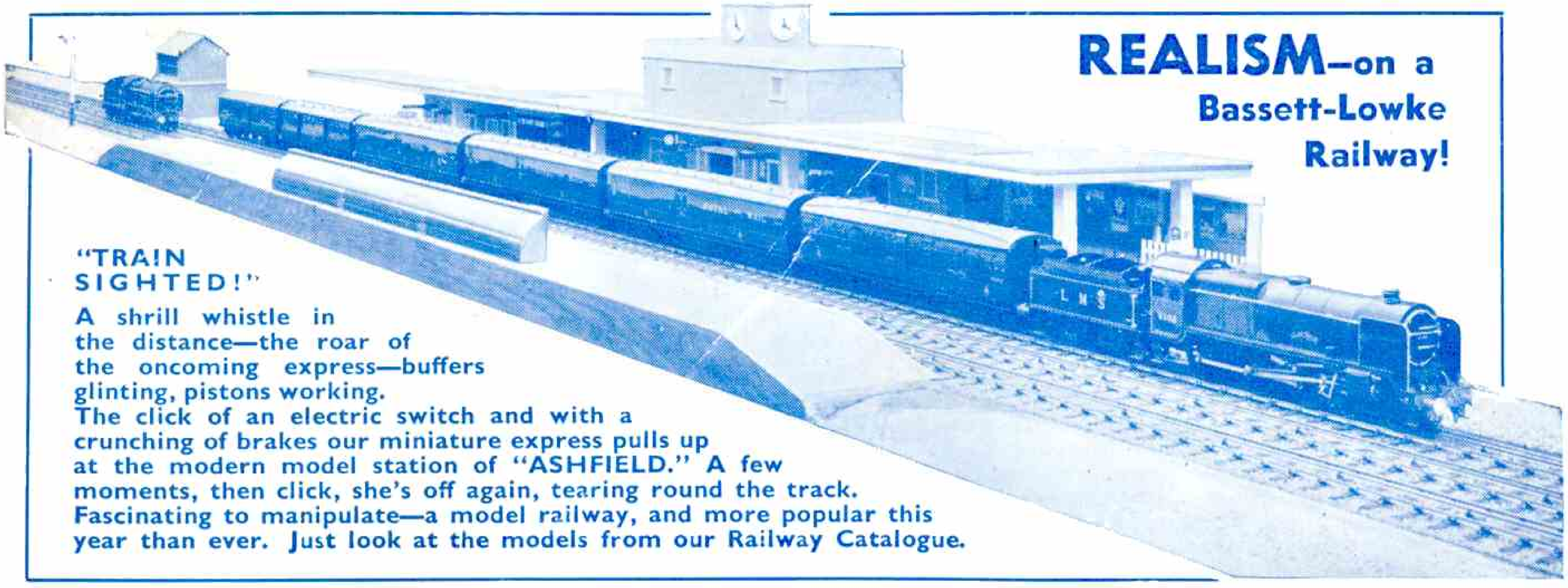
Marvellously accurate for target practice.

No license required to purchase.

Senior 45/-, Mark 1 30/-, Junior 20/-, Webley Air Rifle 80/-

Write for List. WEBLEY & SCOTT LTD., 87, WEAMAN STREET, BIRMINGHAM, ENG.

RUN YOUR OWN TRAIN SERVICE!

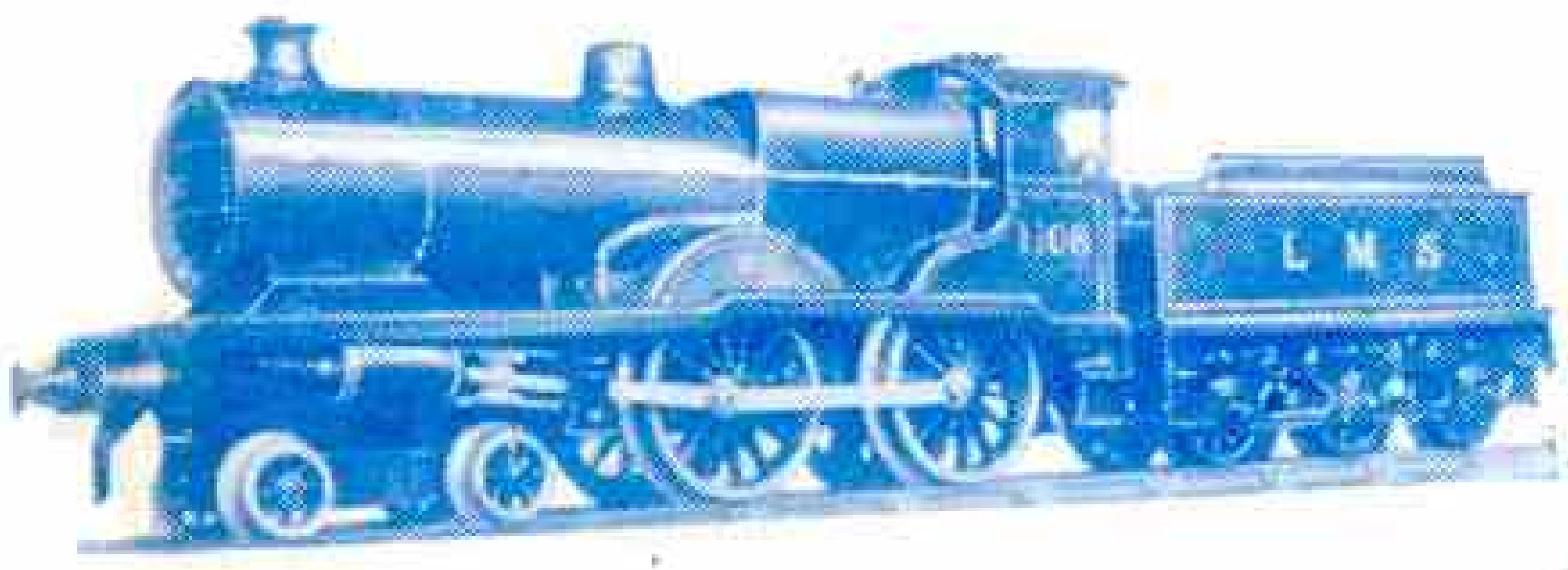


REALISM—on a Bassett-Lowke Railway!

"TRAIN SIGHTED!"

A shrill whistle in the distance—the roar of the oncoming express—buffers glinting, pistons working.
The click of an electric switch and with a crunching of brakes our miniature express pulls up at the modern model station of "ASHFIELD." A few moments, then click, she's off again, tearing round the track.
Fascinating to manipulate—a model railway, and more popular this year than ever. Just look at the models from our Railway Catalogue.

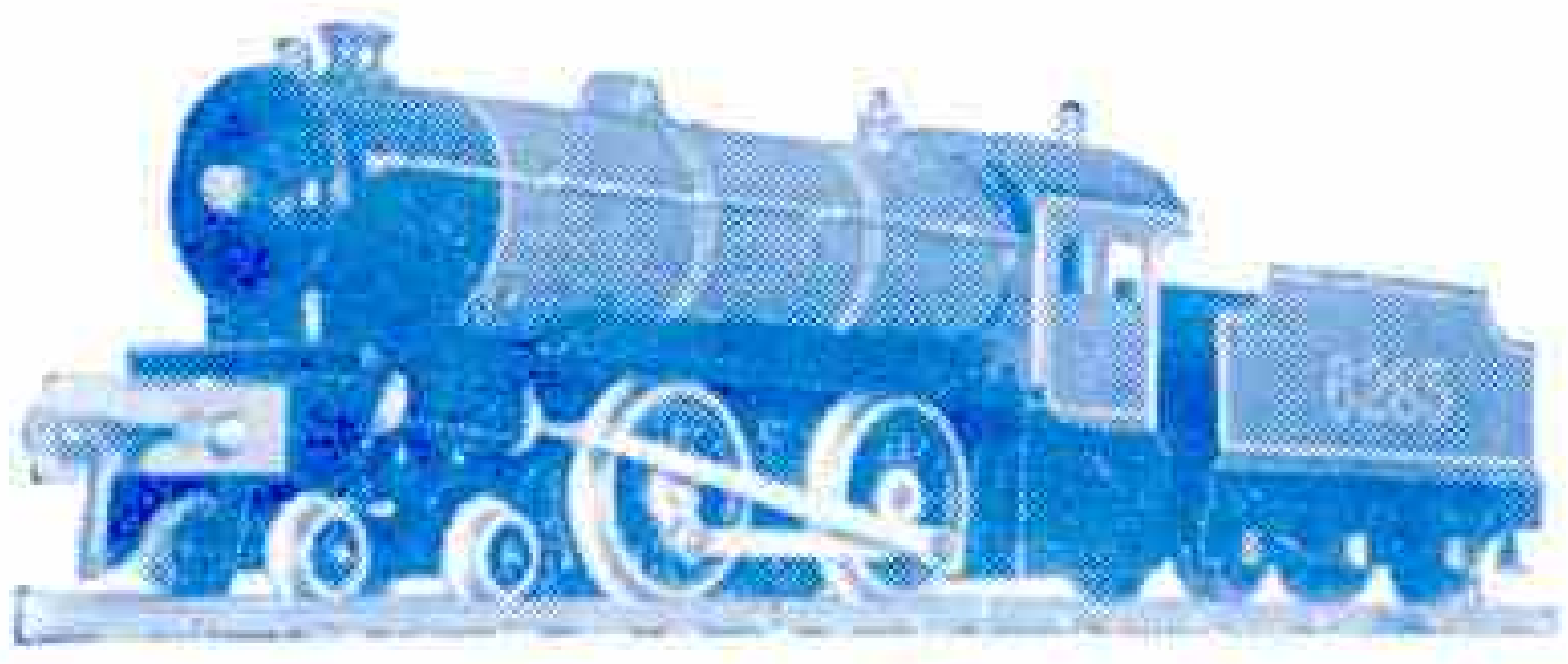
L.M.S. Railway Compound



Our first L.M.S. Compound proved so useful and popular, that this year we have produced an improved design.
NEW prices: Clockwork, 32/6. Electric, 6-8 volts d.c., 39/6; a.c., 44/6.

"ENTERPRISE."

Our gauge "O" steam locomotive, with brass boiler, double action cylinder, reversing motion, etc., an ideal gift. L.M.S. red, G.W.R. Green and Black, 50/-.



G.W.R. 4-6-0 Express Locomotive KING GEORGE V, No. 6000.

A fine super-detail working model of the famous engine which went to America. A new production this season.
Prices: Clockwork and electric, d.c., £8 8s. 0d.; a.c., £9 18s. 6d.

N.B.—Here there is only room for just a glimpse of the many models we have created for this Christmas season, but they are all contained in our new season's **Model Railway Catalogue, A.17.** Price 6d. post free. Also Free Folder of latest lines, FB. 17, available on request. Get your copies now!

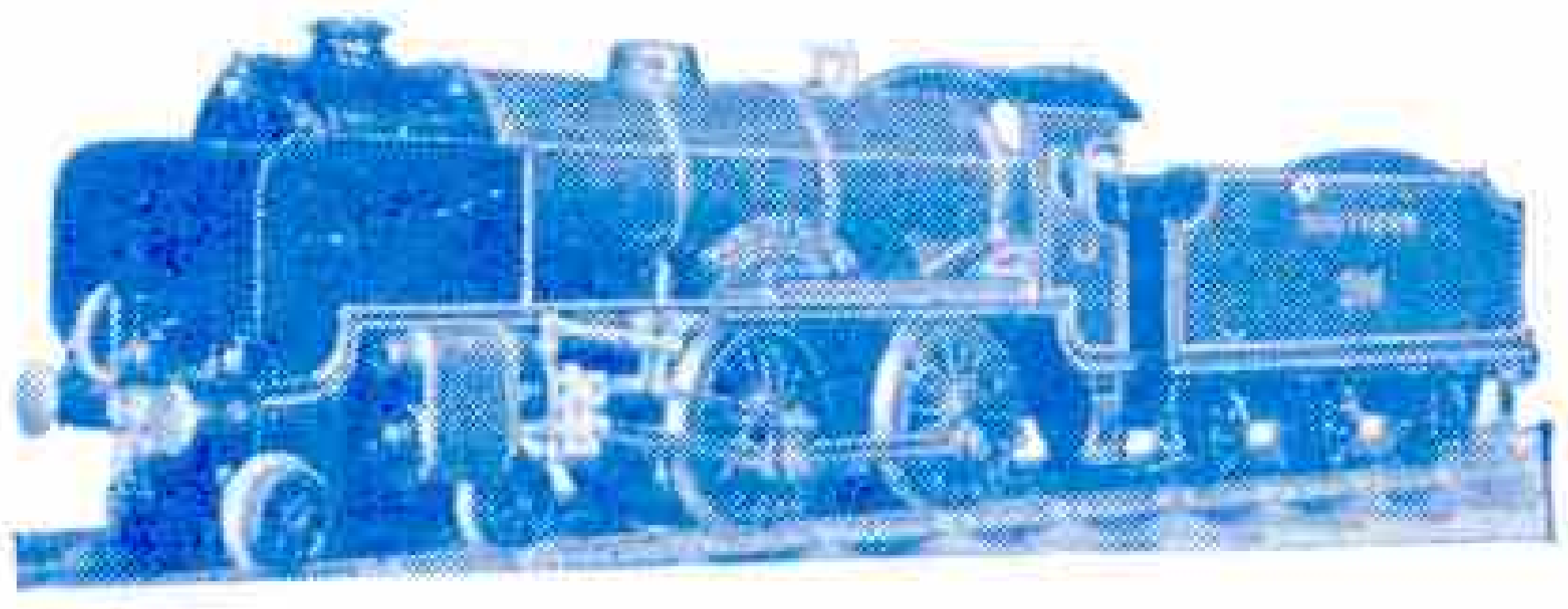
B.17 Engine Catalogue, 6d. S.17 Model Ship Catalogue, 6d.

Standard Tank Locomotive, No. 5374.

Power is a great asset of this smart looking standard Tank Locomotive. Fitted with first class mechanisms.
Prices: Clockwork and electric, d.c., 42/-; a.c., 45/-.

Schools Class "Merchant Taylors," No. 910

An appropriate model for London and the South is our latest S.R. "Schools" class, fitted with smoke deflectors and leading characteristics.
Prices: Clockwork, 90/-; Electric, a.c. and d.c., 105/-.



A SENSATION! THE TWIN TRAIN TABLE RAILWAY! (Gauge 00)

Two electric trains running on the same line at different speeds, in the same or opposite directions, forwards or backwards, fast or slow.

Here are some of the outstanding features of this new gauge "OO" railway, which has astonished the experts and sent thousands of boys wild with delight.

Here is something different, and far ahead of anything of the kind ever attempted before, a scale miniature train system which can be operated in one quarter of the space usually needed.

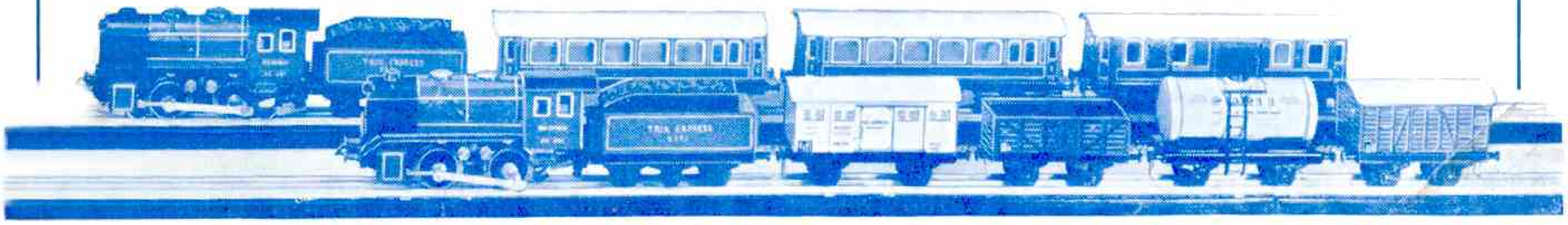
Each vehicle is fitted with automatic couplings, the steel rails are mounted on a specially moulded base keeping the track rigid and smooth running. To join on the rails, point and crossing is the work of a second, and it is just as easy to take them apart.

No description of these trains can possibly do them justice. You must put your hand on the switch before you can realise what a revolution has been created in model railways.

And the price—35/- only for the Passenger Train, 30/- for the Goods—complete with track and controller—is unprecedented value (14 volts a.c., or 12 volts d.c.).

Write for free booklet of the Bassett-Lowke Twin Train Table Railway, TT.17, and be one of the first boys in your town to own a "Twin."

The Twin Trains—Passenger and Goods (Foreign).



BASSETT-LOWKE LTD., NORTHAMPTON

LONDON OFFICE AND SHOWROOMS: 112, HIGH HOLBORN, W.C.1

MANCHESTER OFFICE AND SHOWROOMS: 28, CORPORATION STREET

MECCANO

ENGINEERING FOR BOYS

The Best Hobby in the World for Boys

Every boy is happiest when he is inventing, creating and building. That is the reason for the everlasting popularity of Meccano. It is the most wonderful and the most fascinating hobby in the world, because it enables full scope to be given to all the inclinations and desires that are the natural heritage of boys.

There is no limit to the number of models that can be built with Meccano—Cranes, Clocks, Motor Cars, Ship-Coalers, Machine Tools, Locomotives—in fact everything that interests boys. The most wonderful thing about Meccano is that it is REAL ENGINEERING; yet it is so simple that any boy can join in the delightful fun and excitement of model-building without having to learn anything. A beautifully illustrated Book of Instructions and a screwdriver and a spanner—the only tools required—are included with every Outfit.

Make friends with your dealer—he can help you.

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A Outfit	each	5/-
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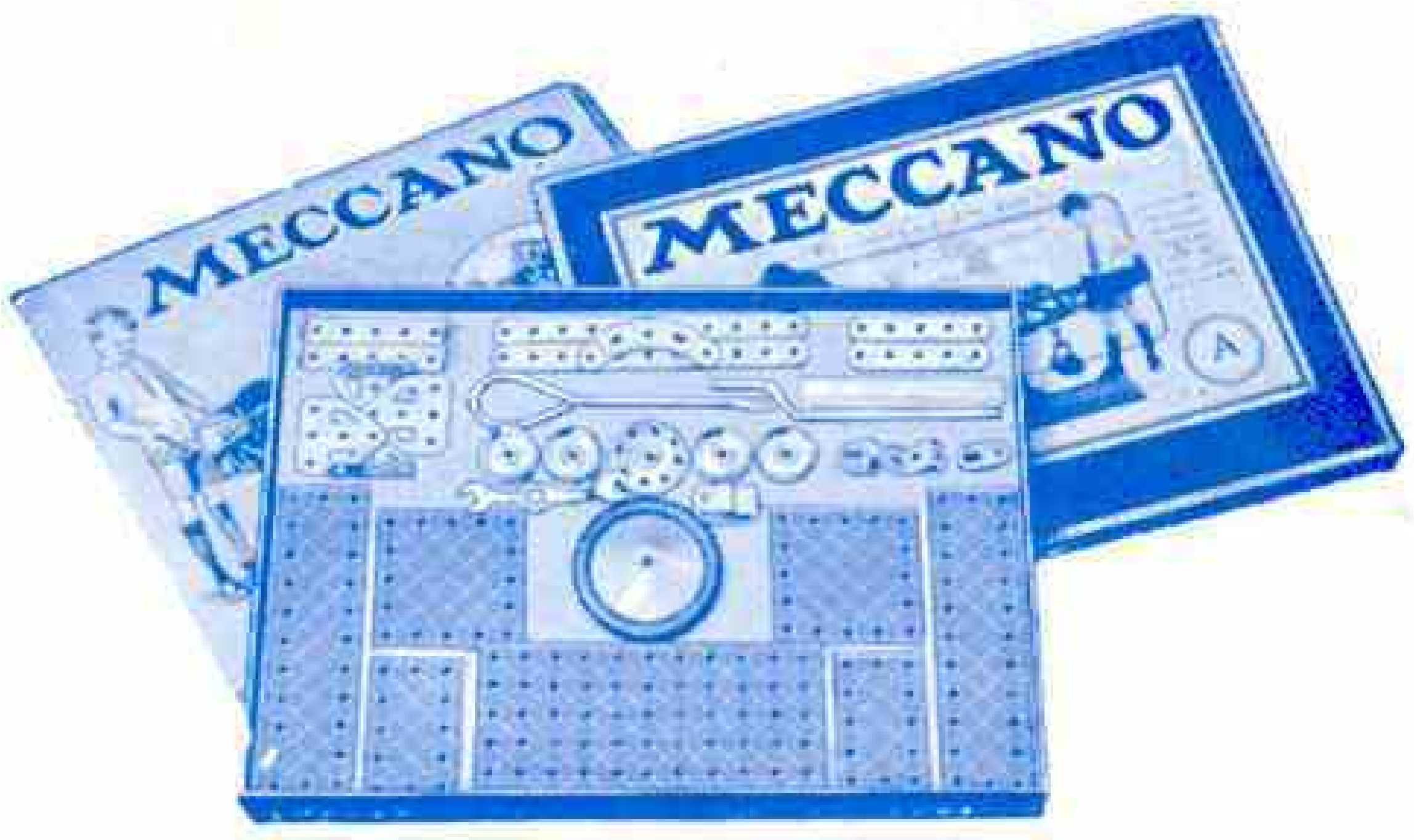
C		10/-
D		15/-
E		20/-
F		30/-
G		55/-
H	(Carton)	72/6
Hw	(Cabinet)	97/6
K	(Carton)	132/6
Kw	(Cabinet)	157/6
L	(..)	400/-

ACCESSORY OUTFITS				
Aa converts	A Outfit	into B	each	2/6
Ba	B	C		3/-
Ca	C	D		5/6
Da	D	E		5/6
Ea	E	F		11/-
Fa	F	G		26/6
Ga	G	H		17/6
Ha	H	K		60/-
Ka	K	L		225/-

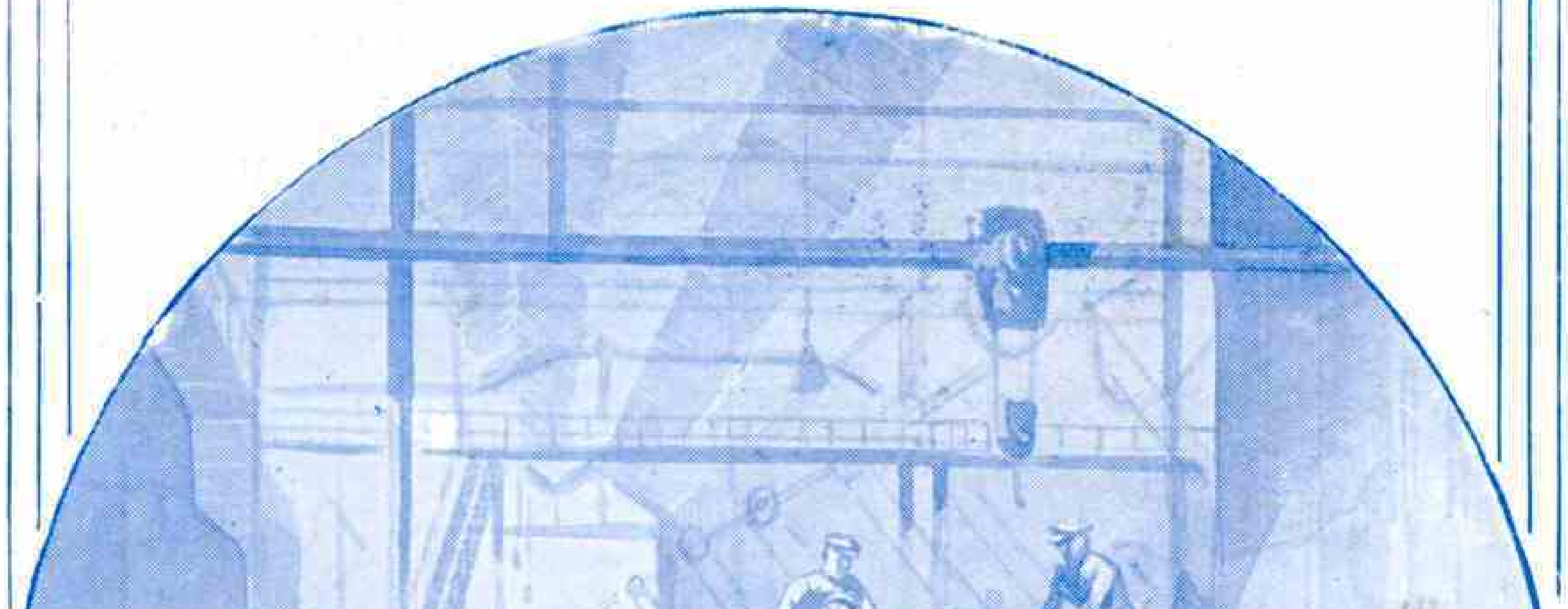
Meccano Limited, Binns Road, Liverpool 13

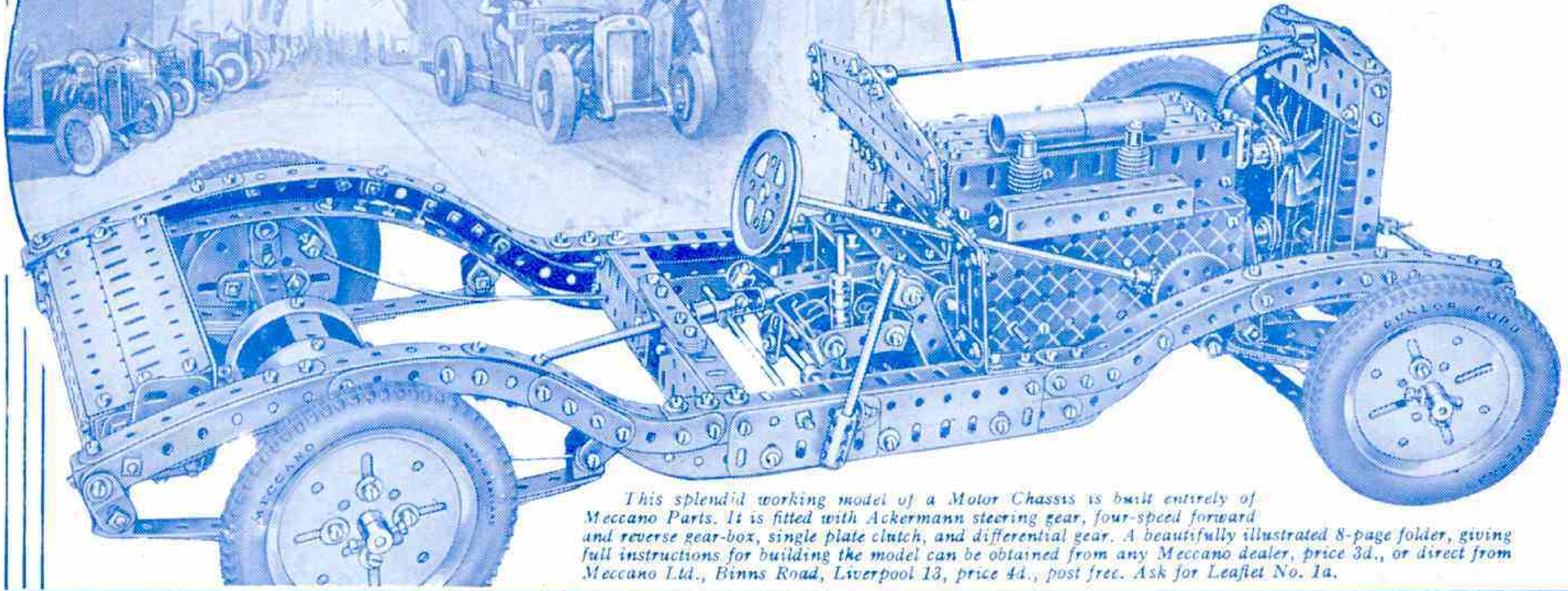


A Meccano Outfit. Price 5/-

D Meccano Outfit. Price 15/-

F Meccano Outfit. Price 30/-





This splendid working model of a Motor Chassis is built entirely of Meccano Parts. It is fitted with Ackermann steering gear, four-speed forward and reverse gear-box, single plate clutch, and differential gear. A beautifully illustrated 8-page folder, giving full instructions for building the model can be obtained from any Meccano dealer, price 3d., or direct from Meccano Ltd., Binns Road, Liverpool 13, price 4d., post free. Ask for Leaflet No. 1a.

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